APPENDIX III-6

Hiawatha #2 Reservoir
Structural Analysis and Hazard Assessment

Hazard Analysis of the Diversion of Water into the Hiawatha No. 2 Mine

U.S. Fuel Company presently uses the Hiawatha No. 2 mine as a water storage reservoir. The quality analysis of water diverted from the North Fork of Miller Creek to underground storage in the old Hiawatha #2 mine is presented in Table VII-6 for stations ST2-A and ST2-B. Water diversion rates to the underground mine storage area are dependent on the time and type of water year. During the late spring to late fall most of the flow from the creek is diverted to underground storage.

The design of the diversion structure is shown in Exhibit III-16, while Exhibit III-17 shows the flow path from the diversion to the point of use. The diversion structure is designed to bypass the 100 year, 24 hour event. Bypasssing of these events would not endanger life, safety, or property as all downstream structures are designed for greater than the 100 year storm.

Plate III-4 shows the relationship between water storage in the mine workings and the bulkhead pressures. The extent and volume of water stored in the mine is presented in Exhibit III-18.

The Hiawatha No. 2 mine is located in the lowest coal seam of the Blackhawk Formation. Therfore, no active or inactive mining operations underlie the mine. Also, with the exception of a storage yard, a supply yard and the access road, no surface facilities are located within the canyon for a distance of two miles downstream. The only facility downstream that may be affected is a supply and auxiliary coal storage yard.

A structural analysis of the bulkhead portals and a hazard assessment in the event of bulkhead failure was undertaken by FB&D for U.S. Fuel Co. Due to the present condition at the mine dams, it is impossible to visually determine the in place condition of the dams. Since the masonry blocks within the dams were installed in 1948, without acquiring core samples and performing the appropriate tests, their design properties are unknown. An approximate analysis based on Section 24 of the current Uniform Building Code (see Figure III-5) and the following assumptions for the concrete block:

1) Unreinforced solid concrete blocks Grade "N" (2500 psi) with type "M" mortar.

2) Allowable compressive stress of cast-in-place concrete 1000 psi.

3) Allowable compressive stress on rock 1000 psi.

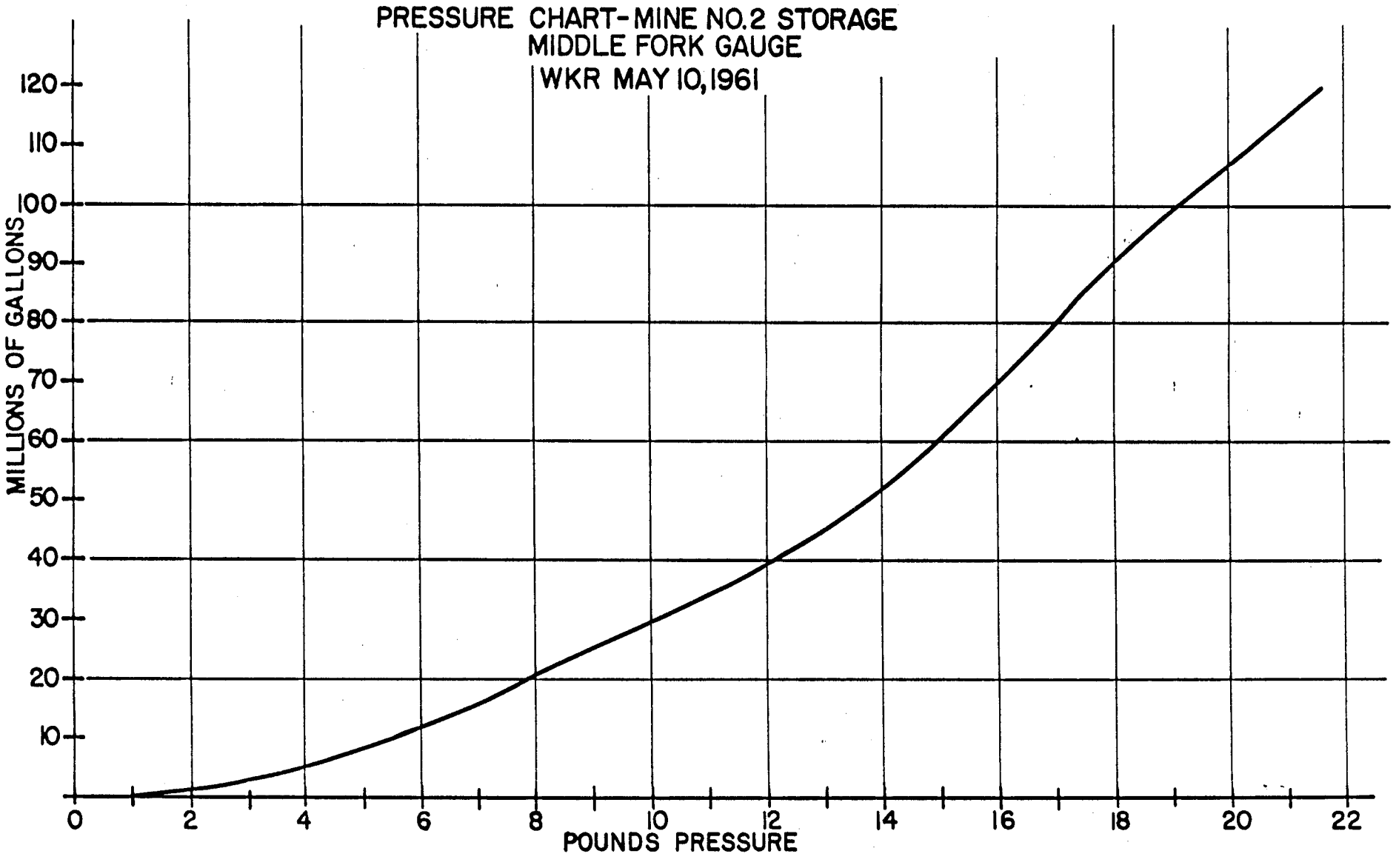

PRESSURE CHART-MINE NO.2 STORAGE
MIDDLE FORK GAUGE
WKR MAY 10,1961
MILLIONS OF GALLONS
120
110
100
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
22
POUNDS PRESSURE

PLATE III-4

The following table lists the findings of this rough analysis.

DAM LOCATION	ALLOWABLE HEAD ABOVE TUNNEL FLOOR
1 Dam for main entry	29.0 feet
2 Dam for return air	50.0 feet
3 Dam for manway	50.0 feet

Our analysis is based on dam data from U.S. Fuel's drawing "Town Water Supply Hiawatha No. 2 Mine Water Storage Underground Dams" (Exhibit III-21).

Any deviation from the above assumptions referring to the type and quality of material used in the dam construction can have an effect on the results listed above. It must further be noted that the above does not take into consideration the existing conditions of the embedded pipes.

Hazard analysis of the impacts of bulkhead failure indicate that worst case conditions (four portals failing simultaneously, at the same time as a 100 year, 24 hour peak flow occurs at the mine site (a very unlikely probability) would yield a peak flow below the mine site of approximately 12,290 cfs (see failure analysis later in this Appendix). To be conservative, this peak flow was not routed downstream (routing would have lowered the peak somewhat) and the downstream structures were evaluated based on the full peak. Under such conditions, 3 or 4 sections of the canyon access road would be inundated, the 5 foot road crossing culvert would be washed out, and the stone arch culvert under the upper portion of the upper coal storage yard would be overtopped.

The risk to personnel safety is uncertain. Under general circumstances, mine personnel would not be traveling the canyon in a 100 year storm, therefore it is expected that given the situation, little impact would occur.

Evaluation of the impact of pipeline failure was also evaluated. Based on calculations shown in later in this Appendix, the peak flow from a pipeline failure would be 12.6 cfs. This flow would spill onto a coal supply yard and enter the Middle Fork of Miller Creek. This flow would not endanger life, safety or property and would be handled by the downstream structures.

No future construction is presently planned in areas that would be inundated by the combined flood of the 100 year storm and bulkhead failure.

2-13-84

TABLE NO. 24-B—ALLOWABLE WORKING STRESSES IN UNREINFORCED UNIT MASONRY

MATERIAL	TYPE M	TYPE S	TYPE M OR TYPE S MORTAR				TYPE N		
	Compression[1]	Compression[1]	Shear or Tension in Flexure[2 3]		Tension in Flexure[4]		Compression[1]	Shear or Tension in Flexure[2 3]	
1. Special inspection required	No	No	Yes	No	Yes	No	No	Yes	No
2. Solid brick masonry									
4500 plus psi	250	225	20	10	40	20	200	15	7.5
2500-4500 psi	175	160	20	10	40	20	140	15	7.5
1500-2500 psi	125	115	20	10	40	20	100	15	7.5
3. Solid concrete unit masonry									
Grade N	175	160	12	6	24	12	140	12	6
Grade S	125	115	12	6	24	12	100	12	6
4. Grouted masonry									
4500 plus psi	350	275	25	12.5	50	25			
2500-4500 psi	275	215	25	12.5	50	25			
1500-2500 psi	225	175	25	12.5	50	25			
5. Hollow unit masonry[5]	170	150	12	6	24	12	140	10	5
6. Cavity wall masonry solid units[5]									
Grade N or 2500 psi plus	140	130	12	6	30	15	110	10	5
Grade S or 1500-2500 psi	100	90	12	6	30	15	80	10	5
Hollow units[5]	70	60	12	6	30	15	50	10	5
7. Stone masonry									
Cast stone	400	360	8	4	—	—	320	8	4
Natural stone	140	120	8	4	—	—	100	8	4
8 Unburned clay masonry	30	30	8	4	—	—	—	—	—

[1]Allowable axial or flexural compressive stresses in pounds per square inch gross cross-sectional area (except as noted). The allowable working stresses in bearing directly under concentrated loads may be 50 percent greater than these values.

[2]This value of tension is based on tension across a bed joint, i.e., vertically in the normal masonry work.

[3]No tension allowed in stack bond across head joints.

[4]The values shown here are for tension in masonry in the direction of running bond, i.e., horizontally between supports.

[5]Net area in contact with mortar or net cross-sectional area.

FIGURE III-5 ALLOWABLE WORKING STRESSES IN UNREINFORCED UNIT MASONRY.

HAZARD ANALYSIS OF BULKHEAD SEAL FAILURE

SUBJECT DETERMINATION OF DISCHARGE FROM BULKHEAD FAILURE JOB NO. MC-528-330

FILE NO.

BY T. J. SUCHOSKI DATE 8 FEB '84 CHECKED BY DATE

ASSUME:

→ FLOW FROM BULKHEAD SEAL FAILURE OCCURS AS ORIFICE FLOW

Eq. $Q = L A \sqrt{2gH}$

A = AREA OF PORTALS

H = HEAD CHANGE FROM UPSTREAM WATER SURFACE TO CENTER OF ORIFICE

C = DISCHARGE COEFFICIENT

$g = 32.2$ FT/SEC^2

→ SEALS 5.5-7FT HIGH

→ AVERAGE PRESSURE RECORDED AT BULK HEAD = 13 lbs/sq in

→ FAILURE WOULD OCCUR ON ALL FOUR PORTAL SEALS AT ONE TIME.

SUBJECT Determination of Discharge From Bulkhead Seal Failure

JOB NO. UC-5ZB-330

FILE NO.

BY VJ Suchoski DATE 9 Feb 84 CHECKED BY DATE

Determine Head From Pressure

$13\ \#/in^2 * 144\ in^2/ft^2 = 1872\ \#/ft^2$

$1872\ \#/ft^2 * \frac{1}{62.4\ \#/ft^3} = 29.99\ ft \approx 30\ ft$

Determine Area of Individual Portals

	Width	x	Height		
Portal 1	= 7.3	*	7	=	51.10 ft²
Portal 2	= 17.5	*	6	=	105.00 ft²
Portal 3	= 11.8	*	5.5	=	64.90 ft²
Portal 4	= 11.0	*	6	=	66.00 ft²

Evaluation of Discharge Coefficient

Assume failure will take the entire bulkhead opening - allowing water to flow full thru portal

Discharge Coefficient = 0.82

(See attached figure)

Friction Losses in Copper and Brass Tubing and Pipe; C-130

8 Inch

Flow — US Gal Per Min	Type K Tubing 7.625" Inside Dia. .271" Wall Thk. Velocity ft./sec.	Type K Tubing Head Loss ft./100 ft.	Type L Tubing 7.725" Inside Dia. .200" Wall Thk. Velocity ft./sec.	Type L Tubing Head Loss ft./100 ft.	Type M Tubing 7.785" Inside Dia. .170" Wall Thk. Velocity ft./sec.	Type M Tubing Head Loss ft./100 ft.	Flow — US Gal Per Min
500	3.55	.664	3.42	.642	3.37	.579	500
550	3.91	.780	3.76	.715	3.71	.692	550
600	4.26	.916	4.10	.858	4.05	.813	600
650	4.61	1.06	4.44	.975	4.39	.942	650
700	4.97	1.22	4.78	1.12	4.72	1.08	700
750	5.32	1.39	5.13	1.27	5.06	1.23	750
800	5.68	1.56	5.46	1.43	5.40	1.38	800
850	6.04	1.75	5.80	1.61	5.73	1.55	850
900	6.39	1.95	6.15	1.79	6.07	1.72	900
950	6.75	2.14	6.49	1.97	6.40	1.90	950
1000	7.10	2.36	6.84	2.17	6.74	2.09	1000
1100	7.81	2.81	7.52	2.59	7.42	2.50	1100
1200	8.52	3.30	8.20	3.04	8.10	2.93	1200
1300	9.24	3.84	8.88	3.53	8.76	3.40	1300
1400	9.95	4.40	9.56	4.04	9.44	3.90	1400
1500	10.7	5.00	10.2	4.60	10.1	4.43	1500
1600	11.4	5.66	10.9	5.18	10.8	4.99	1600
1800	12.8	7.01	12.3	6.44	12.1	6.21	1800
2000	14.2	8.50	13.7	7.83	13.5	7.54	2000
2200	15.6	10.1	15.0	9.33	14.9	8.98	2200
2400	17.0	11.9	16.4	11.0	16.2	10.6	2400
2600	18.5	13.8	17.8	12.7	17.5	12.3	2600
2800	19.9	15.9	19.2	14.6	18.9	14.1	2800
3000	21.3	18.0	20.5	16.5	20.2	15.9	3000
3200	22.7	20.3	21.9	18.6	21.6	18.0	3200
3400	24.2	22.7	23.2	20.9	22.9	20.1	3400
3600	25.6	25.2	24.6	23.2	24.3	22.4	3600
3800	27.0	27.8	26.0	25.6	25.6	24.7	3800
4000	28.4	30.7	27.3	28.2	27.0	27.2	4000
4200	29.8	33.6	28.7	30.8	28.3	29.7	4200
4400	31.2	36.6	30.0	33.6	29.7	32.4	4400
4600	32.7	39.7	31.4	36.5	31.0	35.2	4600
4800	34.1	43.0	32.8	39.5	32.4	38.1	4800
5000	35.5	46.4	34.2	42.6	33.7	41.1	5000
5500	39.1	55.3	37.6	50.8	37.1	49.0	5500
6000	42.6	65.0	41.0	59.8	40.5	57.6	6000
6500	46.1	75.5	44.4	67.6	43.9	66.2	6500
7000	49.7	86.4	47.9	79.5	47.3	75.6	7000

3/10

Ingersoll-Rand.

CONDENSED HYDRAULIC DATA

WATER DATA

FLOW THROUGH ORIFICES AND NOZZLES

Approximate discharge through orifice or nozzle.

$$Q = 19.636\, K d^2 \sqrt{h} \sqrt{\frac{1}{1-\left(\frac{d}{D}\right)^4}} \quad \text{where } \frac{d}{D} \text{ is greater than .3}$$

$$Q = 19.636\, K d^2 \sqrt{h} \quad \text{where } \frac{d}{D} \text{ is less than .3}$$

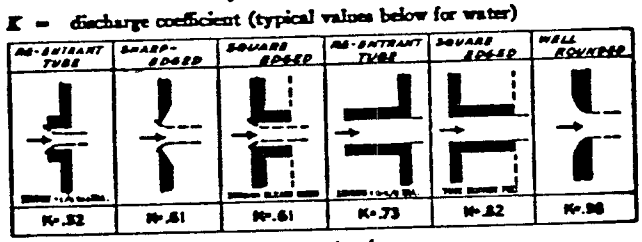
Q = flow, in gpm

d = dia. of orifice or nozzle opening, in.

h = differential head at orifice, in feet of liquid.

D = dia. of pipe in which orifice is placed.

K = discharge coefficient (typical values below for water)



Approximate flow through Venturi tube.

$$Q = 19.05\, d^2 \sqrt{H} \sqrt{\frac{1}{1-\left(\frac{d}{D}\right)^4}} \quad \text{for any Venturi tube}$$

$$Q = 19.17\, d^2 \sqrt{H} \quad \text{for a Venturi tube in which } d = 1/3\, D$$

Q = flow, in gpm

d = dia. of venturi throat, in.

D = dia. of main pipe, in.

H = diff. in head between upstream end and throat (ft.).

These formulae are suitable for any liquid. However, K varies with liquid viscosity, the values given here being for water. A value of 32.174 ft. per sec was used for the acceleration of gravity and a value of 7.48 gal per cu ft in computing the constants. A value of .97 was used for K in the Venturi formulae.

Discharge Determination

$$Q = C_o \sqrt{2g\,H}\,(A_1 + A_2 + A_3 + A_4)$$

$$= 0.82 \sqrt{2 \times 32 \times 30}\,(51.1 + 105.0 + 64.9 + 66.0)$$

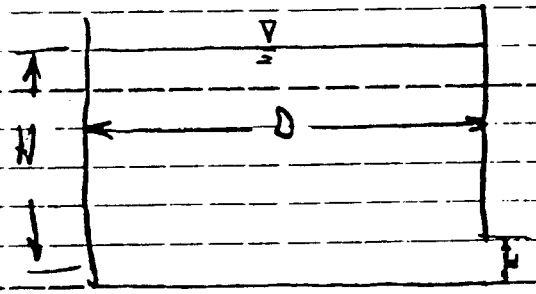
$$= 0.82 \sqrt{1932}\,(340.9)$$

$$= 12,286.96 \approx 12,290 \text{ CFS}$$

$$\text{Velocity} = \frac{Q}{A} = \frac{12290}{340.9} = 36.1 \text{ ft/s}$$

Duration of Discharge

Assume: Res. represented by a tank with opening in the side (See Diagram)



$$t = \frac{2D^2}{C_D d^2 \sqrt{2g}}\left(h_o^{1/2} - h_1^{1/2}\right)$$

t = seconds

Assume Cd remains constant while tank dewaters

H_o = 30 FT for tank with 50 mill gal. capacity

$\therefore$ D = 532.6 FT

Area of opening = 340.9 FT²

$\therefore$ d = 20.83 FT

$$t = \frac{2(532.6)^2}{0.82(20.83)^2\sqrt{2\times32.2}}\left(30^{\frac{1}{2}} - 0^{\frac{1}{2}}\right)$$

$$= \frac{567,325.5}{2855.2}\left(5.48\right)$$

$$= \frac{1,088.9 \text{ sec}}{60 \frac{\text{sec}}{\text{min}}} = 18.15 \text{ min}$$

CHECK: $\frac{\text{Volume of water}}{\text{Discharge Rate}} = \text{Duration of Flow}$

$$\frac{6,684,491.98 \text{ ft}^3}{12,290 \text{ cfs}} = 543.9 \text{ sec}$$

$$= 9.06 \text{ min}$$

* Allowing that discharge decreases with lowered head the 18 min duration of flow is acceptable.

Ford, Bacon & Davis Utah Inc.

SHEET 6 OF 10

SUBJECT DETERMINATION OF FLOW OCCURING FROM A JOB NO. UC-528-330

E FAILURE FILE NO.

BY S DATE 9 FEB 84 CHECKED BY DATE

ASSUME:

→ PIPE FLOWING FULL

→ PIPE DIAMETER = 8 in = 0.667 ft

$$Q = C_D A \sqrt{2gH}$$

$$= 0.82 \left(\frac{8}{12}\right)^2 \pi \sqrt{2(32.2)}$$

$$= 12.6 \text{ CFS}$$

$$= 5,650 \text{ gal/min}$$

SUBJECT IMPACT OF BULKHEAD FAILURE ON DOWNSTREAM STRUCTURES

BY TJ SUCHOSKI DATE 9 FEB '84 CHECKED BY DATE

Assume:

- PEAK FLOW FROM THE 100 YR - 24 hr STORM is 94.3 CFS (SEE TABLE
- PEAK DISCHARGE FROM FAILURE OF BULKHEADS is 12,290 CFS

→ BOTH PEAKS OCCUR SIMULTANEOUSLY AT THE MINE SITE.

ADDING THE PEAKS YIELDS 12,384.3 CFS.

ROUTING THIS PEAK DOWNSTREAM WOULD YIELD A SLIGHTLY LOWER PEAK, HOWEVER FOR THE SHORT DISTANCE TO THE FIRST DOWNSTREAM STRUCTURE (1.25 MILES) THE REDUCTION OF THE PEAK WOULD NOT BE ENOUGH TO PROTECT THE 5 FT ROAD CROSSING CULVERT.

IMPACT → THE CULVERT CAPACITY WOULD BE EXCEEDED AND THE FLOW WOULD OVER TOP THE ROAD.

DOWNSTREAM ANOTHER 0.5 MILE A LARGE STONE ARCH CULVERT is LOCATED UNDER THE RAIL ROAD TRACKS AT THE UPPER END OF THE UPPER COAL STORAGE YARD. THE CAPACITY OF THE CULVERT is:

$$\text{AREA} = (12 \times 12) + \tfrac{1}{2}\pi(6)^2 = 200.5 \text{ FT}^2$$

$$\text{SLOPE} = \frac{7 \text{ FT DROP}}{280 \text{ FT LENGTH}} = 0.03$$

ROUGHNESS = MANNING'S $n = 0.020$
BASED ON MORTERED STONE CHANNEL LINING.

$$R = \frac{A}{P} = \frac{200.5}{73.7} = 2.72$$

$$P = (3 \times 12) + 2\pi(6) = 73.7$$

ASSUMING: OPEN CHANNEL FLOW

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

$$= \frac{1.49}{0.02} (2.72)^{2/3} (0.03)^{1/2}$$

$$= 25.1 \text{ FPS}$$

$$Q = A * V$$

$$= 200.5 * 25.1$$

$$= 5041.32 \text{ CFS}$$

ASSUMING: ORIFICE FLOW

$$Q = C_D A (2gH)^{0.5} = 0.8 (200.5) (2(32.2) 30)^{0.5}$$

$$= 7,050 \text{ CFS}$$

$A = 200.5$

$g = 32.2$

$H = 30 \text{ FT} \Rightarrow 12 \text{ FT ABOVE TOP OF CULVERT}$

$C_D = 0.8$

IMPACT → THEREFORE THIS CULVERT WILL NOT BE ABLE TO HANDLE THE PEAK FLOW AND WILL BE OVERTOPPED.

DOWNSTREAM @ 0.6 MILE FROM THE UPPER COAL STORAGE CULVERT IS ANOTHER STONE-ARCH CULVERT (15 x 22). THE CAPACITY OF THIS CULVERT IS:

ASSUMING OPEN-CHANNEL FLOW

MANNING'S EQ:

$$Q = \frac{1.49}{0.02} A R^{2/3} S^{1/2}$$

$$= \frac{1.49}{0.02}(313.4)(5.40)^{2/3}(0.03)^{1/2}$$

$$= 9,143.9 \doteq 9,140 \text{ cfs}$$

ASSUMING ORIFICE FLOW

$$Q = C_D A (2gH)^{0.5} = 0.8(313.4)(2(32.2)50)^{0.5}$$

$$= 14,230 \text{ cfs}$$

$A = 313.4 \text{ FT}^2$

$H = 50 \text{ FT}$

$C_D = 0.8$

$g = 32.2$

IMPACT → NONE - CULVERT IS MORE THAN CAPABLE OF HANDLING THE UNROUTED PEAK FLOW FROM BREACH OF BULKHEADS AND 100-YR FLOOD FROM MIDDLE FORK CANYON.

CHANNEL AREA REQUIRED TO PASS THE PEAK FLOW IS:

ASSUME: VELOCITY IN THE STREAM CHANNEL IS 25 FT/SEC

$Q = AV$

$12290 = A(25)$

$A = 500\ FT^2$

AVERAGE NARROW CHANNEL AREA IS

CROSS-SECTION*	AREA	CHANNEL SLOPE
A	132.5 FT²	5%
B	336.0 FT²	4%
C	350.0 FT²	3%
D	475.0 FT²	4%
E	440.0 FT²	5%

IMPACT → ROAD UP MIDDLE FORK WILL BE INUNDATED BY FLOOD WATER IN 3 to 4 LOCATIONS. THESE AREAS, WITH THE EXCEPTION OF THE ROAD BELOW THE PORTALS, WILL BE IN THE BACK WATER AREA OUTSIDE THE MAINSTREAM AND WILL NOT RECEIVE MUCH DAMAGE.

* Roman # CROSS-SECTIONS OBTAINED FROM 1" = 200' Recdn. FROM NARROW STREACHES OF THE CANYON TO DETERMINE THAT AREAS THAT WOULD BE INUNDATED

Ford, Bacon & Davis
Incorporated
Engineers-Constructors

November 2, 1983 UC-528-304

Mr. John Barton
District Manager
Mining Safety and Health Administration
P. O. Box 25367
Denver, Colorado 80225

Re: Approval of Water Diversion into an Underground Coal Mine

Dear Mr. Barton:

U.S. Fuel Company has been directed by the Office of Surface Mining to gain approval from the Mining Safety and Health Administration, as required under 817.55(g), for diversion of water into and storage in an underground coal mine. The mine under consideration is the old abandoned Hiawatha #2 Mine located in Hiawatha, Carbon County, Utah.

Enclosed are plans for the diversion structure from the left fork of the North Fork of Miller Creek into the abandoned mine, a flow path plan showing the route of water from diversion to processing facilities or to active underground mine workings, and a figure showing the relationship of water stored in the mine to bulkhead pressure readings at the mine entries.

The mine dips to the south, so water diverted from the creek naturally flows to the mine entries. Conveyance of the water is by pipe to either the processing facilities or to underground mine workings.

The water is retained in the mine using concrete block bulkheads. No design drawings for these bulkheads are available; however, discussions with Mr. Robert Eccli, Chief Mine Engineer for U.S. Fuel have provided a verbal description of the bulkhead construction. Mr. Eccli obtained this information from discussions with miners who worked on the construction of the bulkheads.

(continued)

375 Chipeta Way · P.O. Box 8009 · Salt Lake City, Utah 84108
(801) 583-3773 · Telex 38-8312

The bulkheads ranging from 7 to 17.5 feet wide and 7 to 8.5 feet high, consist of two arched concrete walls keyed 18 to 24 inches into the coal on both sides and into the top and bottom rock of the entry. The area between the walls was backfilled with cement to prevent leakage.

U.S. Fuel Company would appreciate an expeditious review and approval. If you have any further questions, or require additional information, please contact Mr. Robert Eccli, Chief Mine Engineer, U.S. Fuel Company, P. O. Box "A," Hiawatha, Utah 84527; telephone (801) 343-2471. Thank you.

Sincerely,

FORD, BACON & DAVIS, INCORPORATED
Utah Division

Thomas J. Suchoski
Hydrologist

TJS/km

cc: Robert Eccli, U.S. Fuel Company (with attachments)

Attachments

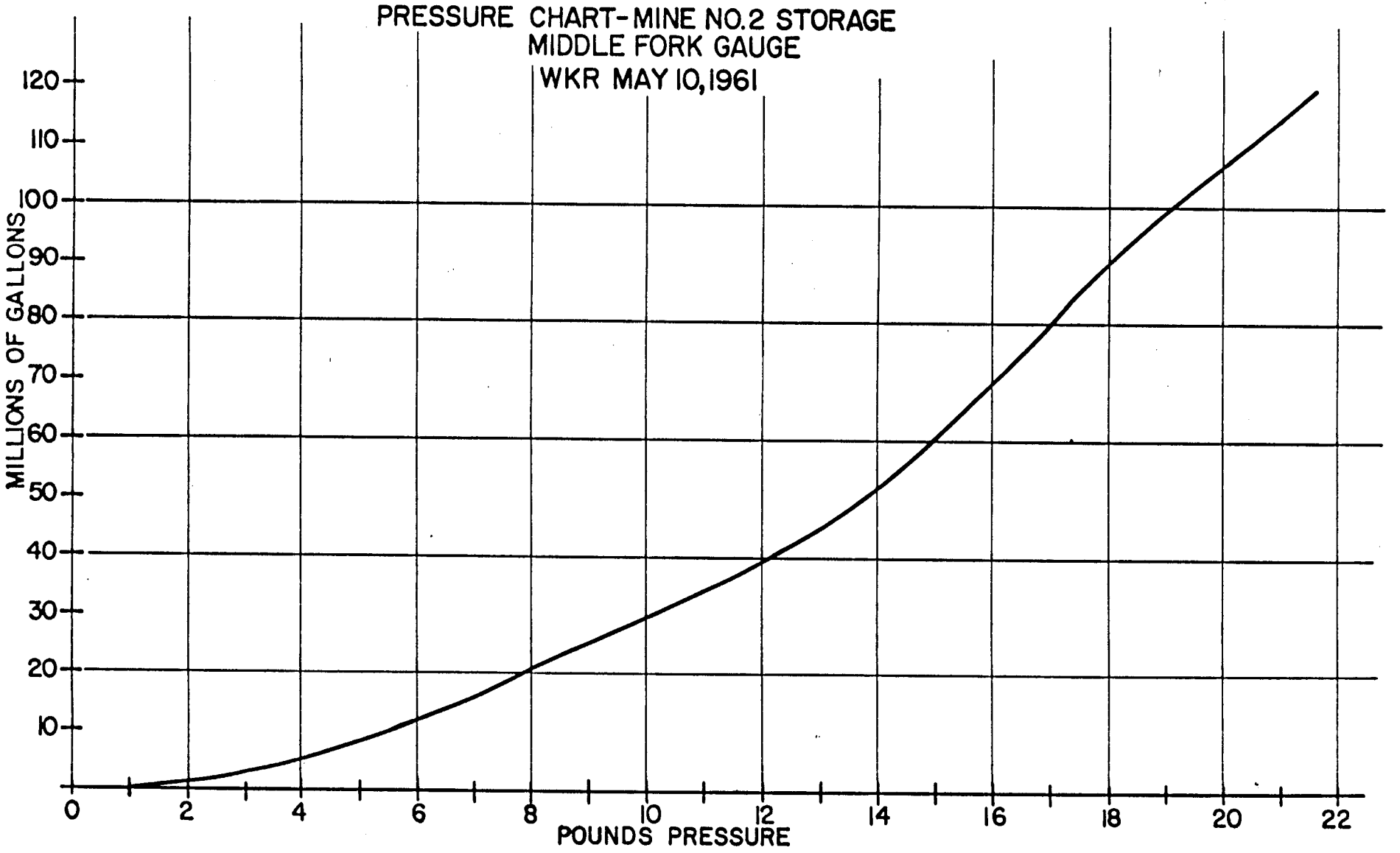

PRESSURE CHART-MINE NO.2 STORAGE
MIDDLE FORK GAUGE
WKR MAY 10,1961
MILLIONS OF GALLONS
120
110
100
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
18
20
22
POUNDS PRESSURE

PLATE III-4

Ford, Bacon & Davis
Incorporated
Engineers-Constructors

January 22, 1985

U. S. Fuel Company
Mr. Bob Eccli
Hiawatha, Utah 84527

SUBJECT: SUMMARY OF TEST RESULTS & ENGINEERING ANALYSIS OF BULKHEADS FOR UNDERGROUND RESERVOIR, HIAWATHA NO. 2 MINE

Dear Bob:

Per our phone conversation, an evaluation of the Sergent Hauskin & Beckwith Test Report along with Ford, Bacon and Davis' engineering analysis is enclosed. Also a copy has been sent to Mr. Monty Christo of the Safety and Health Technology Center in Denver, per your request.

If there are any further questions or assistance FB&D can provide, please contact us.

Sincerely,

Eric Schomaker
Project Manager

ES/ah

Enclosure

375 Chipeta Way · P.O. Box 8009 · Salt Lake City, Utah 84108
(801) 583-3773 · Telex 38-8312

SUMMARY OF TEST RESULTS AND ENGINEERING ANALYSIS OF BULKHEADS FOR UNDERGROUND RESERVOIR FOR U. S. FUELS, HIAWATHA NO. 2 MINE

The results from Sergent Haushins & Beckwith (SH&B) core sample test of the "EAST MOST" bulkhead were received by Ford, Bacon and Davis (FB&D) on January 2, 1985. A review of SH&B's results indicates that the concrete block and grout used for the construction of the existing "EASTMOST" bulkhead (dam) appear to be in good condition. The water side of the of the bulkhead tested exhibits approximately 4" of deterioration.

This particular bulkhead (EAST MOST) is subjected to wetting and drying along with freeze-thaw cycles. This should account for the 4" deterioration of the water side of the bulkhead. It must be noted at this time, that there are no concentrations of chemical ions considered damaging to concrete.

The core samples also indicate that the construction of this bulkhead does not deviate from the design drawings.

It is FB&D's opinion that the remaining bulkheads are continually submerged and would, therefore, be considered not to have been exposed to the adverse conditions described above and should not exhibit any water side deterioration.

Utilizing SH&D compression test results and employing the American Concrete Institute (ACI 318.77), section on unreinforced concrete and analysis was conducted on the remaining bulkheads. FB&D also choose to reduce the wall

thickness from 24" to 20" and set a maximum head of 29.45' (12.75 psi) to be conservative. The results of this analysis were favorable and the following conclusions can be made:

ALLOWABLE HEAD FOR BULKHEADS

Bulkhead (dam)	Allowable Head Above Tunnel Floor
1. Dam for main entry	29.45'
2. Dam for return air	29.45'
3. Dam for main way	29.45'

With the bulkhead for main entry (lowest dam) located at elevation 8079.0', the maximum elevation of stored water should not be allowed to exceed 8108.45'. U. S. Fuels will not store more than 24,000,000 gallons of water, which is equal to a stored water elevation 8098.7'. This difference of elevations represents a reserve storage head of 9.8'. Also with the "EAST MOST" bulkhead opened permanently, the maximum head would only be allowed to peak at elevation 8102.0' (6.45' less than design allowable).

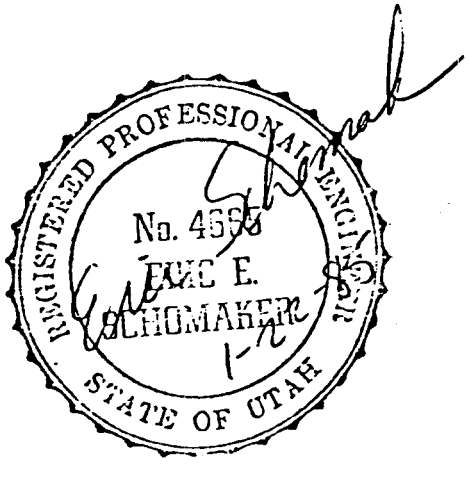
From all information gathered, it can be safely concluded that the remaining three bulkheads discussed, are adequate to store a volume of water not to exceed 24,000,000 gallons (roughly 8.5 psi).

In order to maintain this maximum stored water volume, U. S. Fuels agreed to implement the following operating procedures:

1. Maintain a record of the pressure readings once a week at the main entryway bulkhead (using both the existing pressure gauges to ensure the accuracy of the readings).

2. Provide overflow using the "EAST MOST" portal entry (El 8102') which was opened as a result of Sergent Hauskins and Beckwith's data collection and will be fenced to prevent access.

Please note: Included is a copy of Sergent Hauskin & Beckwith's test report as well as a copy of FB&D's bulkhead analysis.



Ford, Bacon & Davis Incorporated

SHEET 1 OF 8

SUBJECT U.S. Fuels Bulkheads (U.S.F.B.) JOB NO. UC528-1973

FILE NO.

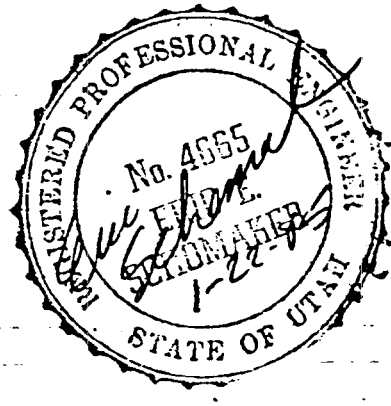
BY E. Schomaker DATE 1-20-85 CHECKED BY DATE

8.5 psi reading on gauge represents a 24,000,000 gallon storage capacity

To be conservative assume maximum water pressure equal to 1.5 x 8.5 psi = 12.75 psi

8.5 psi = a equalent head of 19.6 ft

12.75 psi = a equalent head of 29.45 ft



Based on 12.75 psi wall load at lowest pt will be

$12.75 \times 144 \frac{in^2}{ft} = 1836 \frac{lb}{ft} \times 1\,ft\,(\text{wide strip}) = 1836 \frac{lb}{ft^2}$

This makes maximum head to be elev. 8079' + 29.45' = 8108.45'

It must be noted that "east most" bulkhead (upper one) has been opened for use as an overflow which therefore limit head to 8102 - 8079 = 23'-0

23'-0 < 29.0' Plus maximum allowable head is set to be 19.6' < 23 < 29.0' ok

DESIGN ANALYSIS BASED ON AMERICAN CONCRETE INSTITUTE (ACI 318-77) UNREINFORCED CONCRETE

TO BE CONSERVATIVE USE 50% OF ALLOWABLE VALUES AND 50% OF ACTUAL TEST

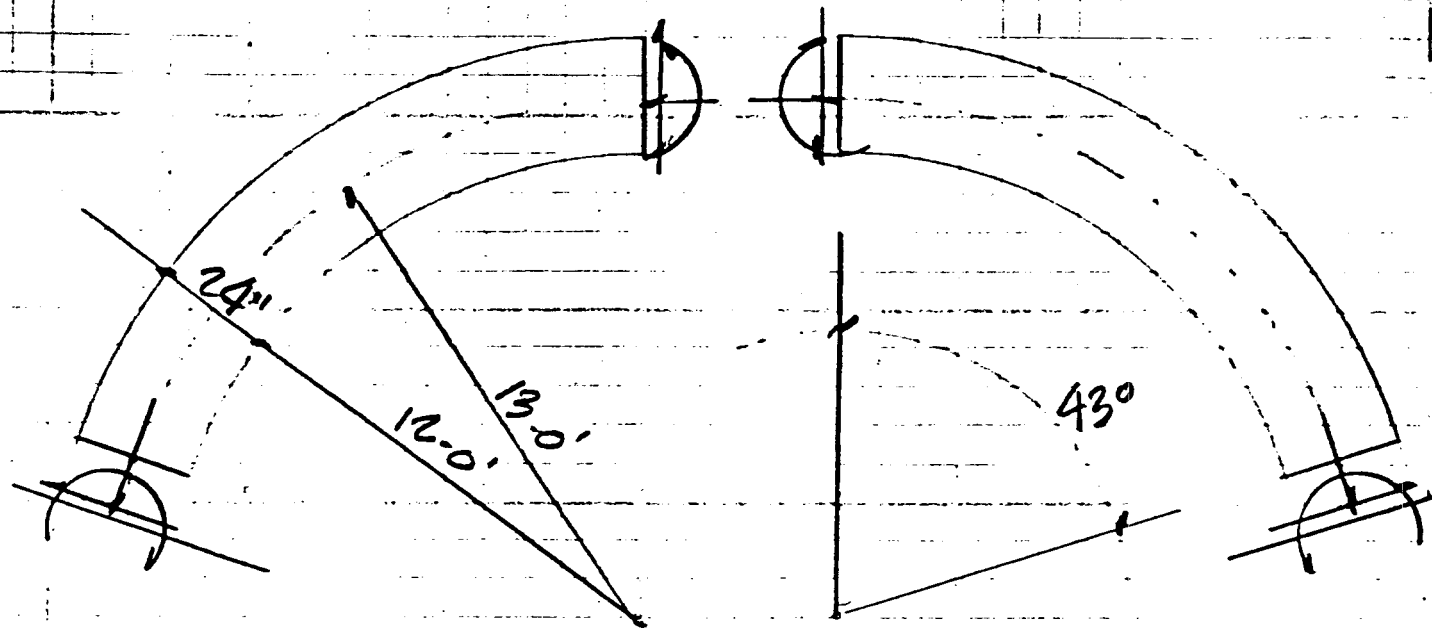
COMPRESSION OF CONCRETE BLOCK & GROUT = 4400 psi ∴ USE f'_c = 2200 psi

ALLOWABLE COMPRESSION = $\frac{2200}{1.7}$ = 12.94 psi/2 = 647 psi

ALLOWABLE TENSION = $5\phi\sqrt{f'_c}$ = $5 \times .65 \times \sqrt{2200}$ = 152 psi/2 = 76 psi

ALLOWABLE SHEAR $2\sqrt{2200} \times .5$ = 47 psi

THESE VALUES ARE CONSERVATIVE



ASSUME 20" OF WALL TO BE EFFECTIVE ∴ $\frac{t}{12} = \frac{20}{154} = .130$

COEFFICIENT @ CROWN

h = 900.8

M = 15.84

FORCE EQUALS

H = 900.8 × 12.83 × 1.836 = 21219 lbs

M = 15.84 × 12.83² × 1.836 = 4787' lbs

COEFFICIENT @ ABUTMENT

h = 942.2

M = -25.9

V = -108.9

H = 942.2 × 12.83 × 1.836 = 22194 lb

M = -25.9 × 12.83² × 1.836 = -7821.5' lb

V = 108.9 × 12.83 × 1.836 = -2565 lbs

$I = \frac{bd^3}{12} = \frac{12 \times 20^3}{12} = 8000 \text{ IN}^4$

COMPRESSION AND ~~TENSION~~ @ CROWN

$\frac{P}{A} = 21219 / 12 \times 20 = -88.4 \text{ psi}$

$\pm \frac{Mc}{I} = \pm \frac{4187 \times 12 \times 10}{8000} = \pm 11.8 \text{ psi}$

COMP $= -88.4 + -11.8 = -160.2 \text{ psi} < 647 \text{ psi}$

COMP $= -88.4 + 11.8 = -16.6 < 647 \text{ psi}$

NO TENSION @ CROWN

COMPRESSION @ ABUTMENT

$\frac{P}{A} = 22194 / 12 \times 20 = -92.5 \text{ psi}$

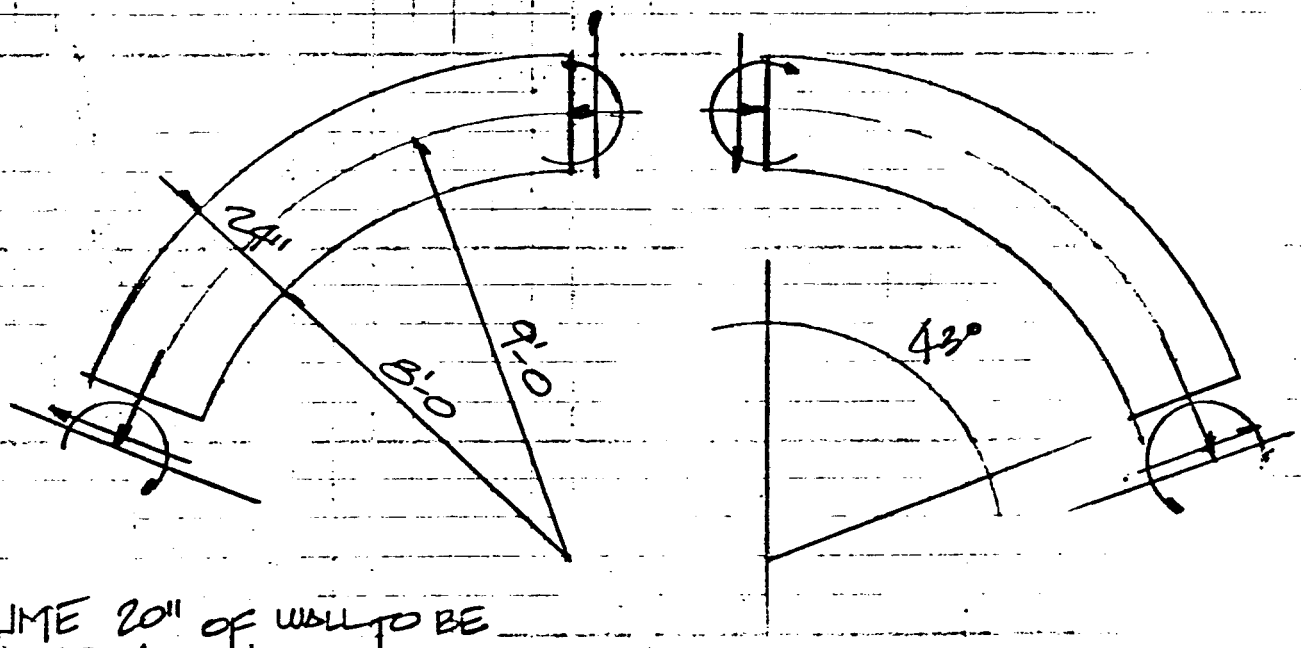
$\pm \frac{Mc}{I} = \pm - \frac{7827.5 \times 12 \times 10}{8000} = \pm 117.4 \text{ psi}$

COMP. $= -92.5 + 117.4 \text{ psi} = 209.9 \text{ psi} < 647 \text{ psi}$

TENSION $= -92.5 + 117.4 \text{ psi} = 24.9 \text{ psi} < 76 \text{ psi}$

SHEAR $= \frac{2365}{12 \times 20} = 10.1 \text{ psi} < 47 \text{ psi}$

COMP ON ABUTMENT ROCK $= 209.9 < 630 \text{ psi}$ FROM SH 4 & 8 TESTS.



ASSUME 20" OF WALL TO BE EFFECTIVE ∴ $\frac{t}{R} = \frac{20}{100} = .189$

COEFFICIENT @ CROWN

h = 835.7

M = 20.44

FORCE EQUALS

H = 835.7 x 8.83 x 1.836 = 13548 lbs

M = 20.44 x 8.83² x 1.836 = 3785' lbs

COEFFICIENT @ ABUTMENT

h = 900.5

M = -38.65

V = -168.86

H = 900.5 x 8.83 x 1.836 = 14599 lbs

M = 38.65 x 8.83² x 1.836 = -5530 lbs

V = 168.86 x 8.83 x 1.836 = 2738 lbs

$I = \frac{bd^3}{12} = \frac{12 \times 20^3}{12} = 8000 \text{ IN}^4$

COMPRESSION and TENSION @ CROWN

$\frac{P}{A} = \frac{13548}{12 \times 20} = 56.45$ psi

$\frac{Mc}{I} = \pm \frac{3785 \times 12 \times 10}{8000} = \pm 56.78$ psi

COMP $= -56.45 + -56.78 = -113.23$ psi $<$ 647 psi

TENSION $= 56.45 + 56.78 = +0.33$ psi $<$ 76 psi

COMPRESSION AND TENSION @ ABUTMENTS

$\frac{P}{A} = \frac{14599}{12 \times 20} = -60.83$ psi

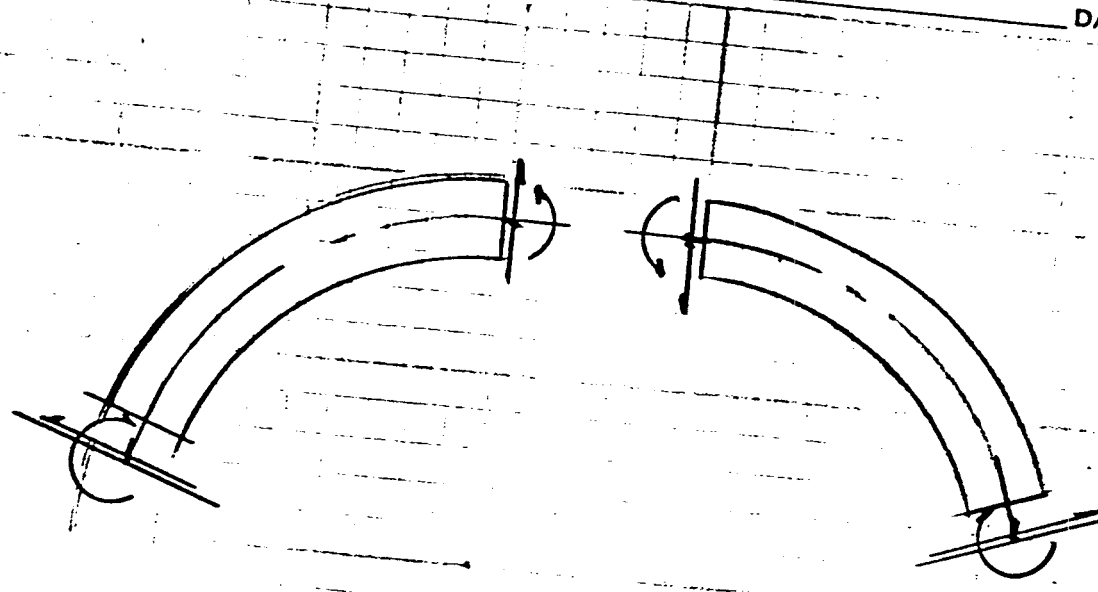
$\frac{Mc}{I} = \pm \frac{5533 \times 12 \times 10}{8000} = \pm 83$ psi

COMP $= -60.83 - 83 = -143.83$ psi $<$ 647 psi

TENSION $= -60.83 + 83 = +22.17$ psi $<$ 76 psi

SHEAR @ ABUTMENT $\frac{V}{A} = \frac{2738}{12 \times 20} = 11.4$ psi $<$ 47 psi

COMP ON ABUTMENT ROCK $= 143.8$ psi $<$ 630 psi



ASSUME 20" OF WALL TO BE EFFECTIVE ∴ $\frac{t}{R} = \frac{20}{82} \approx .250$

COEFFICIENT @ CROWN

h = 600.9

M = 43.7

FORCE EQUALS

H = 600.9 × 6.83 × 1.836 = 75

M = 43.7 × 6.83² × 1.836 = 37

COEFFICIENT @ ABUTMENT

h = 601.9

M = -57.4

V = -306.2

H = 601.9 × 6.83 × 1.836 = 75

M = 57.4 × 6.83² × 1.836 = 491

V = 306.2 × 6.83 × 1.836 = 384

$I = \frac{bd^3}{12} = \frac{12 \times 20^3}{12} = 8000 \text{ in}^4$

COMPRESSION AND TENSION @ CROWN

$\frac{P}{A} = 1535/12\times20 = -31.4$ psi

$\frac{Mc}{I} = \frac{3743\times12\times10}{8000} = \pm 56.1$ psi

COMP $= -31.4 - 56.1 = -87.5$ psi $<$ 647 psi

TENSION $= -31.4 + 56.1 = +24.7$ psi $<$ 76 psi

COMPRESSION & TENSION @ ABUTMENTS

$\frac{P}{A} = 1548/12\times20 = -31.5$ psi

$\pm\frac{Mc}{I} = \frac{-4916\times12\times10}{8000} = \mp 73.74$ psi

COMP $= -31.5 + 73.74 = 105.2$ psi $<$ 647 psi

TENSION $= -31.5 + 73.74 = 42.3$ psi $<$ 76 psi

SHEAR $= 3840.7/12\times20 = 16$ psi $<$ 47 psi

COMP. ON ABUTMENT Rock 105.2 psi $<$ 630 psi

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING • HYDROLOGY

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December 26, 1984

Ford, Bacon & Davis, Inc.
375 Chipeta Way
Salt Lake City, Utah 84108

SHB Job No.E84-2034

Attn: Mr. Jack Elder

Re: Bulkhead Testing
Underground Reservoir
Hiawatha No. 2 Mine
U.S. Fuel Company
Hiawatha, Utah

Gentlemen,

Per your request, transmitted herewith are the results of tests performed on core samples taken from the fourth or east most bulkhead for the referenced project. The cores were obtained on December 3 through December 6, 1984 by using portable concrete coring equipment. Table I lists the core designation, general location and description. Table 2 presents the uniaxial compressive strength test results. The core samples are available for inspection and will be held for three months, at which time they will be destroyed unless further notified. Pictures of the bulkhead and the coring operation were taken while the samples were being obtained. A copy of the photos were delivered to Eric Shoemaker on December 10, 1984.

In cutting the smaller diameter cores from the back side of the 8 inch diameter core which penetrated all the way through the bulkhead, it was noted that several inches of the core broke apart into small pieces in the coring process. The beginning of a competent core began approximately 3 to 5 inches in from the back face of the bulkhead.

Visually there appeared to be a good bond between the mortar and concrete block in the cores which were taken from the bulkhead.

The cores taken in the coal were of poor to marginal testing quality due to the highly fractured and jointed nature of the material.

Per our discussion, no analysis of the bulkhead design has been performed. If we can be of further service, please contact us at your convenience.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By Donald L. Curran
Donald L. Curran, P.E.

DLC/clc

Copies (4)

Bulkhead Testing
Hiawatha No. 2 Mine
U.S. Fuel Company
Hiawatha, Utah
SHB Job No. E84-2034

TABLE 1
CORE DESIGNATIONS

Core No.	Core Hole Diameter (inches)	Core Location	Date Obtained	Core Log
1	3	Right side of bulkhead	12-3-84	0.4" Gunite 6.1" Coal & grout-contact plane parallel to core axis. 13.5" Coal
1A	3	Right side of bulkhead	12-3-84	0.5" Gunite 16.2" Concrete block with mortar beds. 2.3" Grout
1B	3	Right side of bulkhead	12-3-84 12-4-84	5.9" Gunite 18.1" Concrete block with mortar beds & some sand pockets.
1C	3	Right side of bulkhead	12-4-84	0.7" Gunite 23.3" Concrete block with mortar beds.
1D	3	Right side of bulkhead	12-4-84	0.5" Gunite 20.5" Concrete block with mortar beds. 2.5" Grout 0.5" Coal
1E	3	Right side of bulkhead	12-5-84	5.4" Gunite 17.6" Coal

Bulkhead Testing
Hiawatha No. 2 Mine
U.S. Fuel Company
Hiawatha, Utah
SHB Job No. E84-2034

TABLE 1
CORE DESIGNATIONS

Core No.	Core Hole Diameter (inches)	Core Location	Date Obtained	Core Log
1F	2.5	Right side of bulkhead	12-6-84	1.9" Gunite 11.3" Concrete block with mortar beds. 10.8" Grout
2	3	Left side of bulkhead	12-4-84	0.6" Gunite 37.5" Concrete block with mortar beds. 1.9" Grout
2A	2	Left side of bulkhead	12-4-84	1.7" Gunite 10.3" Concrete block with mortar beds.
2B	2	Left side of bulkhead	12-4-84	0.7" Gunite 11.3" Concrete block
2C	2	Left side of bulkhead	12-4-84	0.8" Gunite 33.4" Concrete block with mortar beds. 6.8" Grout
2D	3	Left side of bulkhead	12-4-84	0.6" Gunite 11.4" Concrete block with mortar beds and sand pockets.

Bulkhead Testing
Hiawatha No. 2 Mine
U.S. Fuel Company
Hiawatha, tah
SHB Job No. E84-2034

TABLE 1
CORE DESIGNATIONS

Core No.	Core Hole Diameter (inches)	Core Location	Date Obtained	Core Log
2E	2	Left side of bulkhead	12-4-85	1.6" Gunite 10.4" Concrete block with mortar beds.
2F	2.5	Left side of bulkhead	12-6-84	1.2" Gunite 10.1" Grout 8.7" Coal
3	3	Roof of portal	12-5-84	60.0" Coal
4	2.5	Floor of portal	12-5-84	27.9" Coal 4.1" Sandstone
5	8	Right of center and 2/3 way up bulkhead	12-5-84	0.7" Gunite 24.3" concrete block with mortar beds.

Bulkhead Testing
Hiawatha No. 2 Mine
U.S. Fuel Company
Hiawatha, Utah
SHB Job No. E84-2034

TABLE 2
TEST RESULTS

Core No.	Mtrl. Tested	Core Dia. (in.)	Trimmed Length (in.)	Density (lb/ft)	Corrected Uniaxial Compressive Strength (psi)	Young's Modulus (10 psi)	Date Tested	Failure Mode
1A	Concrete*	2.72	5.64	137.9	4,429	1.7	12-17-84	Shear Plane @ 30° to core axis.
1C	Concrete**	2.13	4.94	129.6	4,771	-	12-17-84	Split longitudinally along mortar joint.
1F	Grout	2.14	4.24	136.9	3,948	-	12-15-84	Numerous cracks parallel to core axis.
2F	Grout	2.14	4.39	137.1	3,137	1.9	12-15-84	Shear plane @ 30° to core axis.
2F	Coal	2.14	3.93	79.1	1,267	0.28	12-17-84	Failure plane poorly defined.
3	Coal	2.73	5.34	78.2	630	0.07	12-17-84	Failure plane poorly defined.
4	Sandstone	2.13	3.34	165.5	12,817	2.4	12-15-84	Failure plane poorly defined.
5	Concrete***	2.25	4.64	127.9	2,116	0.76	12-15-84	Shear plane @ 30° to core axis.

* Concrete block - front of bulkhead.
** Concrete Block - front of bulkhead with mortar plane parallel to core axis.
*** Concrete Block - back of bulkhead.

Appendix III-7

APPENDIX III-7

King IV Portal Breakout

KING IV INTAKE AIR BREAKOUT

On January 25, 1984 United States Fuel Company was granted conditional approval for the Middle Fork breakout. This .47 acre annex to the King IV mine yard will undergo incorporation into the disturbed area and be a source of additional air intake for the mine. It may also serve as a beltway from the mine to the coal pile. Exhibit III-1C depicts the proposed arrangement. The present conveyor line will continue to be used in conjunction with the new system after it is installed.

The conveyor will be 380 feet long and 100 feet high at the coal pile tower (discharge point). The belt will be covered and will have a walkway along it's length for maintanance purposes. Final engineering drawings will be submitted when they are completed.

The peak flow for the watershed above the proposed portals was calculated using the SCS triangular unit hydrograph methodology. This was developed for computer application for the Division of Oil, Gas and Mining by Dr. Richard H. Hawkins (1979). Results of the method for two sets of data input show that the peak flow is approximately 2.3 cfs or less. See Table VII-10A. Therefore a 12 inch culvert will be adequate for the runoff from this area. The culvert will capture all of the runoff from the new disturbance and convey it to the sediment pond below.

Sampling of the proposed disturbance area, .47 acres, indicates approximately one foot of topsoil material could be stripped from the area and stockpiled to aid postmining reclamation and revegetation.

An average stripping depth of 18 inches was used to calculate a quantity of soil for removal. Due to undulating, steep topography and the posibility of finding large rock materials within the proposed area, the total anticipated volume may not be found. The topsoil will be stockpiled at the location designated on Exhibit VIII-4.

The reclamation plan for the Middle Fork mine yard will apply to this portion of the mine yard as well. Seed mix number 3 has been designated for use in reclamation of the mineyard site. A reference area has already been designated for the south facing slope of the existing mineyard (Reference Area #1, Exhibit IX-3B) and will be used for the new disturbance as well.

TABLE VII-10A

Peak Flow Determination For Watershed Above Proposed Portals For The King 4 Mine

PARAMETERS	ENLARGED MAP DATA INPUT	DOGM DATA INPUT
Hydraulic Length (ft) =	1440	--
Average Watershed Slope (%) =	64	--
Curve Number =	80	80
Watershed Lag Time (hrs) =	0.053	--
Time of Concentration (hrs) =	0.089	0.14
Precipitation Depth (in) =	2.25	2.25
Runoff Depth (in) =	0.72	0.72
Area (mi^2) =	0.012	0.02
Peak Discharge =	1.39	2.29

Portal Breakout - Topsoil Removal

Field studies and soil sampling were conducted in July, 1983 at the portal breakout. Five sample sites were used to obtain composite samples of the soils at the portal breakout site. (See Exhibit IX-3b). The sampling was completed by driving a two inch (ID) steel pipe into the soil. The pipe was driven to the one foot depth. The pipe was then removed from the soil, the sample extruded and collected in a sample bag for the 0 to 1 foot composite sample. The same procedure was used to obtain samples from the 1 to 2 foot intervals and the 2 to 3 foot intervals. In two of the holes, sampling was restricted to the upper 12 inches due to the presence of cobbles and large gravel sized rock fragments.

The composite samples from each horizon were well mixed and split to obtain a representative sample for each of the three intervals which they represented, the 0 to 1 foot, 1 to 2 foot and 2 to 3 foot zones. These samples were then submitted to Utah State University, an approved agricultural laboratory, to establish the major physical and chemical characteristics of the soils for determination of reclamation suitability. The results of the laboratory analyses (Table VIII-14) indicate that these soils are suitable for reclamation (Table VIII-15).

Based on the cobbly zones in areas of the portal breakout, it will not be possible to remove a uniform depth of topsoil. Where practicable, all the topsoil resource will be removed and stockpiled. For the purpose of volume calculations, a 1.5 foot average depth is believed to be representative. For actual field stripping, the supervisory engineer will need to direct the equipment operators to strip the maximum soil depth possible, a foot of soils from some areas of the portal breakout and up to three feet from other areas to ensure that the cobbles are exluded from the topsoil designated for reclamation. The topsoil will be stripeed, removed and stockpiled, (Exhibit VIII-4) to protect the topsoil resource.

Based on a 0.47 acre area of disturbance, removing a 1.5 foot depth of topsoil would yield 1,137 cubic yards of topsoil.

The topsoil stockpile would be placed on a relatively flat area (Exhibit VIII-4) and would resemble a truncated cone, having less than 2:1 sideslopes and a slightly rounded top.

For details concerning stabilization of the topsoil stockpile see the discussion on the Middle Fork topsoil pile.

The current nutrient levels in the topsoil at the portal breakout are considered moderate. The current levels of the needed soil nutrients and amendments to enhance vegetative regrowth on the stockpiled topsoil have been previously addressed in this section.

Table VIII-[illegible] Portal Breakout

Soils Laboratory Analyses

Area	Depth Feet	% OM	SP[a]	pH	ECe[b]	CEC[c]	SAR	NO_3-N ppm	N %	P ppm	K ppm	Na meq/l	CA+Mg meq/l	$CaCo_3$ %	>2mm	Sand	Silt	Clay	Texture
Portal Breakout	0-1	2.64	35	8.5	0.2	7.7	.3	4.9	.12	5.2	66	.4	3.0	7.8	35.	69	19	12	sandy loam
Portal Breakout	1-2	1.91	30	8.3	0.1	5.7	.4	2.6	.09	4.5	53	.4	2.2	9.8	34.	70	18	12	sandy loam
Portal Breakout	2-3	1.50	33	8.4	0.3	6.1	.4	2.1	.07	12.0	42	.4	3.7	14.6	15.	63	21	16	sandy loam

a = Sp = Percent water at saturation

b = ECe = Electrical conductivity of saturation extract in mmhos/cm

c = CEC = Cation exchange capacity in meq/liter

Table VIII-15. Portal Breakout

Soil Suitability for Reclamation

Depth	% OM	S	SP[a]	S	pH	S	ECe[b]	S	CEC[c]	S	SAR[d]	S	Texture	S	AWC[f]	S	N	SA[g]	NO_3-N	SA	P	SA	K	SA	Na	SA	>2mm	S
0-1	2.64	G	35	G	8.5	P	0.2	G	7.7	G	.3	G	SL	G	1.3	F	.12	L	4.9	L	5.2	L	66	G	.4	G	35.	P
1-2	1.91	G	30	G	8.3	F	0.1	G	5.7	G	.4	G	SL	G	1.3	F	.09	L	2.6	L	4.5	L	53	L	.4	G	34.	P
2-3	1.50	G	33	G	8.4	F	0.3	G	6.1	G	.4	G	SL	G	1.3	F	.07	L	2.1	L	12.0	G	42	L	.6	G	15.	F

a = S = Suitability rating (G = good F = fair P = poor U = unsuitable)

b = ECe = Electrical conductivity of saturation paste in mmhos/liter

c = CEC = Cation exchange capacity

d = SAR = Sodium adsorption ratio

e = Texture = SL = Sandy loam

f = AWC = Available water capacity in inches per foot

g = SA = Suitability of available nutrients (G = good no amendments needed, L = low amendments needed)

When reclamation activities have commenced, immediately prior to redistributing the stockpiled topsoil, the soil will again be sampled and submitted for laboratory analyses to determine the need for additional soil nutrients and amendments.

The soil suitability analyses indicates that the coarse fraction greater than 2 mm is marginal in it's suitability. Although the texture, a sandy loam, has a good suitability for reclamation, however because of the coarse fraction the available water capacity has been reduced. Therefore, redistributing an average of 1.5 feet of topsoil over the entire area during reclamation will mitigate this potential impact.

The salt content of the soil is considered to be low, therefore very conducive to vegetative regrowth. The values for ECe, CEC, SAR, calcium, magnesium and sodium are all within the acceptable levels for plant tolerances (Donahue, 1977).

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Appendix III-8

APPENDIX III-8

Road Maintanance Program

APPENDIX III-8

ROAD MAINTENANCE PROGRAM

Class I and Class II roads will be maintained such that approved design standards are met throughout the life of the entire transportation facility including surface, shoulders, parking and side areas, approach structures, erosion control devices, cut-and-fill sections, and such traffic-control devices as are necessary for safe and efficient utilization of the roads.

Class I road maintenance will include repairs to the road surface such as blading, filling of potholes and replacement of gravel or asphalt on an as-needed basis. Revegetating, brush removal, watering for dust control and minor reconstruction will be performed as needed. Erosion control devices and drainage systems will be cleaned and repaired once a year, in the spring, and as needed throughout the year.

Class I roads damaged by catastrophic events such as floods or earthquakes will not be used until reconstruction of damaged road elements. The reconstruction will be completed as soon as practicable after the damage has occurred.

Class II road maintenance will include basic custodial care as required to protect the road investment and prevent damage to adjacent resources. Erosion control and drainage systems will be cleaned and repaired once a year, in the spring, and as-needed throughout the year. Repair of structures, replacement of surface and restoration of the road prism will be performed as needed.

Class III road maintenance will be performed as needed to ensure minimization of erosion for the life of the road. Class III roads will not be used if climatic conditions are such that usage may cause degradation of water quality.

AGREEMENT

THIS AGREEMENT, entered into as of this 8 th day of February, 1984, by and between UNITED STATES FUEL COMPANY and the TOWN OF HIAWATHA.

United States Fuel Company is the owner of access roads and related drainage control structures serving coal mine facilities in the Left, Middle and Right forks of Miller Creek Canyon in Carbon County, Utah. In accordance with regulations pertaining to Surface Effects of Underground Coal Mining Activities, specifically UMC 784.15 and UMC 817.133 (Postmining Land Use), U.S. Fuel Company proposes to retain these roads upon final reclamation of mine facilities.

In consideration of access necessary for maintenance and repair of vital municipal and culinary water supply systems, U.S. Fuel Company proposes to grant these roads to the town of Hiawatha following final reclamation of mine facilities. The roads as well as the town water supply systems are located within the boundaries of the incorporated town of Hiawatha.

The town of Hiawatha agrees to accept and maintain the roads and related drainage structures in compliance with maintenance standards existing at the time of transferal.

UNITED STATES FUEL COMPANY

By: _____
Vice President and General Manager

TOWN OF HIAWATHA

By: _____
Mayor

_____
Notary Public
5-21-84

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

February 6, 1984

Mr. Larry Dalton
Utah State Division of Wildlife Resources
455 West Railroad Ave.
Price, Utah 84501

Dear Larry:

In connection with U.S. Fuel Company's Coal Mining and Reclamation Plan, we have proposed to reclaim disturbed surface areas to a postmining land use of livestock grazing and wildlife habitat. Existing access roads located in the Left, Middle and Right forks of Miller Creek are proposed to be retained and granted to the town of Hiawatha following final reclamation. These roads will be needed by the town for access to vital municipal water supply systems, including diversion and conveyance structures, existing in these canyons. The roads and water facilities are located within the corporate boundaries of the town.

The office of Surface Mining has requested that we obtain comments from the Division of Wildlife Resources as to their views concerning the retention of these roads. If you have any comments please forward them to me or OSM at your earliest convenience.

Yours truly,

Robert Eccli

Robert Eccli
Senior Engineer

RE:lj

state of utah

DIVISION OF WILDLIFE RESOURCES

DOUGLAS F. DAY
Director

EQUAL OPPORTUNITY EMPLOYER

1596 West North Temple/Salt Lake City, Utah 84116/801-533-9333

Reply To SOUTHEASTERN REGIONAL OFFICE
455 West Railroad Avenue, Box 840, Price, Utah 84501
(801) 637-3310

February 14, 1984

Mr. Robert Eccli
Senior Engineer
U. S. Fuel Company
Hiawatha, Utah 84527

Dear Bob:

In regard to your recent inquiry concerning the Division's position relative to the roads in the Miller Creek Canyons, the following is offered for your consideration.

Obviously, at the time of decommissioning of the mining facilities, wildlife would be most benefited by decommissioning of the roads along with other surface facilities. However, it seems from the MRP as well as from your recent letter, that the roads will serve as access routes to culinary water sources for the town of Hiawatha. Bob, the Division would prefer to see the roads reclaimed and revegetated with a habitat more suitable to the needs of wildlife; however, it may be that the needs of the Hiawatha town for these roads outweigh the need for wildlife. Such a decision is not within the preview of the Division of Wildlife Resources.

I want to take this opportunity to thank you for your concern and consideration for the State's Wildlife Resource.

Sincerely,

John L. Livesay

John Livesay, Supervisor
Southeastern Region

JL:LBD:db

cc: Susan Linner
Darrell Nish

Appendix III - 9

APPENDIX III-9

Unit Train Loadout

Appendix III-9 Index

1) May 10, 1984 Letter to Utah State Division of Environmental Health. RE: Notice of Intent To Construct Coal Loadout Facility.

2) June 12, 1984 Letter from the Division of Environmental Health. RE: Approval of Coal Loadout Facility.

3) May 15, 1984 Letter To Carbon County Engineering Dept. RE: Notice of Intent to Construct Unit Train Loadout Facility.

4) October 30, 1984 Letter From Carbon County, Harold Marsten. RE: Carbon County Approval of Unit Train Loadout.

5) May 14, 1984 Letter To Utah Railway, William Callor. RE: Request For Utah Railway Consent on Unit Train Loadout.

6) May 22, 1984 Letter From Utah Railway, D. Gilson. RE: Utah Railway Response Concerning Unit Train Loadout.

7) May 15, 1984 Letter To Utah Highway Dept. RE: Notice of Intent to Construct Unit Train Loadout Facility.

8) May 17, 1984 Letter From Utah Dept. of Transportation. RE: Approval to Relocate Hwy. 122.

9) June 15, 1984 Letter to MSHA, John W. Barton. RE: Information on Unit Train Loadout.

10) July 9, 1984 Letter to DOGM, Marjorie Larsen. RE: Request For Public Hearing on Hwy 122 Relocation.

11) June 1, 1984 Letter to OSM, Sarah Bransom. RE: Additional Information on the Proposed Unit Train Loadout.

12) UMC 784.11 Operation Plan: Unit Train Loadout Facility
Compliance Plan For Proposed Unit Train Loadout Facility

13) July 11, 1984 Letter to OSM, Allen Klein. RE: Additional Information on Proposed Unit Train Loadout
UMC 782.19 Indentification of Licenses and Permits For the Unit Train Loadout Facility.

14) Soils and Foundation Investigation, November 1978.

15) Soils and Foundation Investigation, March 1979,

16) Railroad Underpass Soil Conditions

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

June 1, 1984

Sarah Bransom
Office of Surface Mining
Reclamation and Enforcement
Brooks Tower
1020 15th Street
Denver, Colorado 80202

Dear Ms. Bransom;

This submittal is in response to OSM's letter of May 1, 1984 requesting additional information on U.S. Fuel Company's proposed unit train loadout.

Seven copies of the following information is provided as outlined in the request.

1. UMC 782.15 (a) Right of Entry and Operation Information

   A letter from the Utah Railway Company supporting the right of U.S. Fuel to construct and operate the unit train loadout within the Utah Railway property is included with this submittal.

2. UMC 782.19 Identification of Other Licenses and Permits

   U.S. Fuel Company is not aware of any special licenses or permits required to construct and operate the unit train facility.

   The following organizations have been notified of our intent and approval letters requested:

   Utah Bureau of Air Quality
   Utah Highway Department
   Utah Railway Company
   Carbon County

3. UMC 783.12 General Environmental Resources Information

   The timing of construction is given in the Operation Plan narrative in Item 7 (UMC 784.11).

4. UMC 783.16 (a) Surface Water Information

Exhibit III-20A included with this submittal gives as-built drawings and locations of ditches and catch basins currently used to divert and contain runoff from the area proposed for construction. This exhibit is included to demonstrate that the current sedimentation control system will accommodate the load-out facility.

5. UMC 783.24 (b) Maps: General Requirements

The area proposed for the unit train loadout facility is located in a previously disturbed area within the permit area boundary. No exhibits need to be changed since the disturbed area boundary already shown on applicable exhibits is not changed.

6. UMC 783.25 (i) and (k) (3) Cross Sections, Maps and Plan

Exhibit III-20A gives pre- and post-construction contour maps of the loadout construction site. No coal refuse material will be removed from the site. Existing material will be regraded to facilitate the loadout and runoff containment.

7. UMC 784.11 Operation Plan: General Requirements

A narrative describing the construction and operation of the loadout facility is included with this submittal.

8. UMC 784.12 (a) and (b) Operation Plan: Existing Structures

A compliance plan in accordance with UMC 784.12 (a) and (b) and all the items of Subchapter K is included with this submittal (Appendix III-7).

A description of the refuse pile is given in Chapter XII of the Permit Application under Geotechnical Information. Exhibit III-20A shows the present configuration of the pile.

Reports on geotechnical testing and recommendations on foundation designs for the loadout faciltiy are included with this submittal.

9. UMC 784.12 (1) (2) (3) Reclamation Plan: General Requirements

Reclamation of the proposed loadout facility is included in the current permit application reclamation plan. A timetable for removal of the facility is given on Page 51 of the November 7, 1983 DOA response. An estimate of the cost to remove and reclaim the facility is included in the reclamation cost estimate for the Hiawatha processing plant and loadout facility (Table III-13 revised May, 1984). A plan for backfilling, soil stabilization,

grading etc, is given on Page 59 and 60 of the January 1, 1984 submittal. Also see Exhibits III-14, 14A, 14.1 and 14.2.

Bond estimates have not been provided by us, but rather, have been estimated by the Division of Oil, Gas and Mining. A revised bond estimate can be determined by them based on our revised table III-13.

There is no corridor (not within the Utah Railway right-of-way) currently being used in conjunction with the loadout that is not considered for reclamation under our reclamation plan.

10. UMC 784.14 (a) and (b) Reclamation Plan: Protection of Hydrologic Balance

A reclamation plan for drainage ways, catch basin, and ditches to be used as sedimentation control structures in connection with the proposed loadout is given in our reclamation plan for the Hiawatha plant site and loadout area. See Page 60 of the April 13, 1984 submittal.

11. UMC 784.15 Reclamation Plan: Postmining Land Use

The postmining land use plan for the unit train loadout facility area will be the same as the rest of the permit area, namely, wildlife habitat and livestock grazing. That portion of the facility within the Utah Railway right-of-way will be dismantled and removed upon abandonment of the facility. The land area will be returned to its original use as railroad corridor. The railroad underpass will not be reclaimed since it will become a permanent part of State Highway 122 which serves the town of Hiawatha.

12. UMC 784.23 (c) Operation Plan: Maps and Plans

Exhibits III-19 20 and 21 submitted for the unit train facility have been revised to show certification by a qualified professional engineer.

13. UMC 784.26 Air Pollution Control Plan

A "Notice of Intent" to construct the loadout facility in accorrdance with Section 3.1 of the Utah Air Conservation Regulations was submitted to the Utah Division of Environmental Health on May 10, 1984. See copy included with this submittal.

14. UMC 784.18 Relocation or Use of Public Roads

Letters have been sent to Carbon County and the Utah Highway Department notifying them of our intent to relocate a portion of Highway 122 and construct an overpass. Notification letters

and an approval letter from the Utah Department of Transportation are included with this submittal.

Sincerely,

Robert Eccli

Robert Eccli
Sr. Mining Engineer

RE:lj

Enclosure

cc: Jim Smith
Division of Oil Gas and Mining

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

May 14, 1984

Mr. William Callor Jr., Division Engineer
Utah Railway Company
P.O. Box 261
Helper, Utah 84526

Dear Mr. Callor;

As you are aware, United States Fuel Company plans to construct a coal loadout facility at the preparation plant in Hiawatha, Utah. As this facility is intended for the loading of unit trains, some construction and modification is proposed to take place on railroad property.

The Federal Office of Surface Mining requires that we provide documentation that supports the right to construct and operate the unit train loadout within the Utah Railway property.

We would appreciate your sending us a letter stating your views in connection with this proposal.

Sincerely,

Robert Eccli

Robert Eccli
Sr. Mining Engineer

RE:lj

cc: E.M. Gardiner

UTAH RAILWAY COMPANY

970 UNIVERSITY CLUB BUILDING
136 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

May 22, 1984

Mr. Robert Eccli
Sr. Mining Engineer
United States Fuel Company
Hiawatha, Utah 84527

Dear Mr. Eccli:

Regarding your letter of May 14, 1984, to Mr. William Callor, Jr., Division Engineer of Utah Railway Company; it has been forwarded to me for response.

Utah Railway will lease to U. S. Fuel Company sufficient land to construct and operate a unit train loading facility.

The Utah Railway also has sufficient land to extend tracks to the east and west in order to handle unit trains from such an operation.

Please keep us informed of the progress in this matter, and by copy of this letter, will request that Mr. Callor assist in any way possible.

Yours very truly,

D. Gilson
Executive Vice President

DG/ld

cc: Mr. E. E. Gardiner
Mr. William Callor, Jr.
Mr. D. E. Martin

CARBON COUNTY
PRICE, UTAH 84501

Sarah Bransom
Office of Surface MIning
Brooks Towers
1020 15th Street
Denver, Colo 80202

October 30, 1984

RE: U.S. Fuel Company Loadout facility road re-alignment

Dear Ms. Bransom,

Please be advised that Carbon County has reveiwed the plans and specifications for the road realignment of U.S. Fuel at Hiawatha, Carbon County, Coal loadout facility. We have no concerns or problems with the load out plan and related road realignment. Please accept this letter as Carbon County's approval of said project.

Sincerely,

Harold R. Marston

Harold R. Marston,
Carbon County Planner

CC: Mr. Robert Eccli Sr.,
P.O. Box A
Hiawatha, Utah

UMC 784.11 Operation Plan: Train Loadout Facility

Construction of the proposed loadout facility will take place near the United States Fuel Company Preparation Plant. The general layout is presented on Exhibit III-3 where the proposed facility is shown located north of the preparation plant. The facility will handle one million tons of washed coal per year.

Raw coal from the King 4, 5 and 6 mines is transported to the Hiawatha preparation facility where it is washed and sized. In the future, it will then travel immediately, by beltline, from the preparation plant to two coal stockpiles (to be located as disignated on Exhibit III-3).

The coal will be transferred by a convered 42 inch, 1075 ton per hour belt line system (refer to Exhibit III-21). The 508 feet of conveyance from the preparation plant to the coal stockpiles will be made up of three 42 inch, 1075 ton per hour conveyor lines connected to one another by two transfer points which are in totally enclosed buildings. A third transfer is from the conveyor into concrete, coal pile stacking tubes. From the enclosed staking tubes coal is discharged from side ports in the tube onto the coal pile.

Each coal pile will have a storage capacity of 25,000 tons and the dimensions of 230 feet in diameter by 81 feet high. A 72 inch, 3000 ton per hour conveyor will run under these two plus a third future coal pile. The 72 inch belt will be enclosed in a concrete tunnel and will load from chutes beneath the coal piles. It will convey the coal to a steel preloading sampling and transfer tower. This enclosed coal transfer preceeds the 615 foot covered conveyor transfer of coal to the point of rail car loading. The car loading unit will be located on railroad property.

The future (third) coal stockpile would have a capacity of 10,000

tons and the dimensions of 60 feet in diameter and 56 feet high. Reclaimed slurry material would be hauled to this pile (from inactive slurry ponds) by 15 ton dump trucks. This material will be blended with material from the other two stockpiles on the 72 inch belt for rail shipment. The trucks would access the pile by the present roads as indicated on Exhibit III-3.

In order to prevent highway blockage by the unit train as it is being loaded, it is necessary to construct a road underpass, approximately 550 feet south of the present railroad crossing, for vehicle traffic (refer to Exhibit III-19). On this drawing construction specifications are noted as well as the location of the proposed underpass and road modifications.

Access routes to the area around the facility will remain basically the same. The present roads, as shown on Exhibit III-3, circumnavigate the stockpile area. The existing road just west of the railroad tracks will remain in place after construction. We do not propose to construct new roads or relocate existing roads to access this facility. See Exhibit III-20A showing pre-construction and post-construction contours.

The refuse area will be regraded to a configuration acceptable for construction and runoff control. See exhibits III-3 and III-20A. Sound engineering practice will be used in the construction of the facility. Design and construction will be carried out by a contracted engineering firm experienced in loadout design and construction. Geotechnical testing and analysies have been performed and recommendations made for the construction of stacking tubes, transfer towers, silo, conveyors and coal stockpiles. See Appendices XII-6, 7 and 8. These reports have been provided to prospective bidders for use in foundation design. Much of the geotechnical testing was done several years ago when preliminary plans were being formulated. Results of the tests and recommendations are pertinent to our current proposal, however, references are made in the reports to some sites and sizes of structures which are not part of our current operating

plan. This is mentioned to avoid confusion on the part of review personnel. Additional testing will be undertaken if recommended by the engineering frim selected to design and construct the facility.

The earthwork, which will consist of the disturbed area regrading plus Highway 122 underpass construction, is projected to last from July 1984 to October 1984.

Following the grading and earthwork, concrete foundations and footings will be formed and poured. This is expected to take an additional three months. Once the foundations and footings are in place, structural, mechanical and electrical work can commence. Final completion and start up of the facility is scheduled for September, 1985.

Construction materials will be basically concrete and steel. The transfer towers and conveyor line will be enclosed or covered. The stacking tubes and 72 inch conveyor tunnel will be made of reinforced concrete.

Runoff from the construction area is already contained by sediment control structures (see Exhibit III-20A)/

During normal operation of the facility, the conveyor line system from the preparation plant to the coal stockpiles would be active during the regular operating schedule of the preparation plant. This averages 16 hours per day for 19-20 working days per month. However, the car loading unit of the loadout facility would operate only when a train was being loaded, or about 12 hours per week for two 80 car unit trains.

As the facility's principal use will be coal transfer, it will be important to maintain the equipment to keep it in a useful state. Greasing conveyor rollers, replacement or splicing of belts, the cleaning of conveyor towers and tunnels as well as any mechanical repairs are some of the routine maintenance measures to be taken.

The coal loading facility will greatly improve the efficiency of the coal handling operations. It will serve to limit the areal extent of stockpiled coal as well as significantly reduce vehicle miles traveled per year for coal hauling and relocation to storage. The life of the facility will correspond with that of the mine. It will be dismantled and the area regraded and reclaimed upon permanent cessation of operations.

Removal of the facility is outlined in the reclamation portion of the permit application. The structure will be dismantled along with the preparation plant facilities at the time of final reclamation and be reclaimed in the same manner. The cost of removal and reclamation is included in Table III-13. Reclamation procedures to be implemented are described in the section that discusses final reclamation of the preparation plant and coal pile areas.

COMPLIANCE PLAN

For

PROPOSED UNIT TRAIN LOADOUT FACILITY

This compliance plan is submitted accordance with UMC 784.12 (a) and (b) and is intended to address the requirements of Subchapter K of UMC 817.

UMC 817.11 Signs and Markers

Mine and permit identification signs are presently in place at each point of access from public roads to the area of surface operations containing the proposed loadout facility.

The perimeter of the area which includes the loadout facility is presently marked by perimeter markers (metal range fence posts).

No land within 100 feet of a perennial stream within U.S. Fuel property is expected to be disturbed by mining activities related to the loadout. Should such a situation occur, the requirements of UMC 817.57 (Stream Buffer Zones) will be complied with.

No blasting is expected to be required in connection with the loadout. If found to be necessary, blasting markers will be posted in accordance with UMC 817.65 (e).

No topsoil is proposed bo be disturbed in the vicinity of the loadout, therefore, no topsoil markers will be required. Topsoil removed from the site of the proposed railroad underpass will be properly stored and clearly marked with appropriate signs.

UMC 817.13 Through 817.15 Casing and Sealing of Underground Openings

Does not apply.

UMC 817.21 Through 817.25 Topsoil

The proposed loadout will be located within a previously disturbed area near the preparation plant. Topsoil requirements for this area are discussed under the heading Preparation Plant, Slurry Ponds, and Coal Refuse Embankments in Chapter VIII of the Application. Topsoil removed from the site of the railroad underpass will be sampled, stored and protected in accordance with plans outlined in Chapter VIII of the Permit Application.

UMC 817.41 Through 817.57 Hydrologic Balance

The proposed loadout will be located within a previously disturbed area which is presently protected by existing runoff diversion and containment structures. See Chapter VII of the Permit Application. Exhibit III-20A shows topographic features and drainages and gives as-built drawings of ditches and catch basins related to the loadout.

UMC 817.61 Through 817.68 Use of Explosives

No explosives are expected to be used in connection with the proposed loadout. Should they be used, all the requirements of UMC 817.67 will be complied with.

UMC 871.71 Through 817.74 Disposal of Excess Spoil and Underground Development Waste

No underground development waste will be generated in the loadout construction process. Spoil derived from the coal stockpile and train loading area will be utilized as backfill within the same area to enhance the as-build surface configuration. See Exhibit III-20A. Spoil derived from the railroad underpass area will be used as backfill on the adjacent roadway profile in a normal cut and fill process.

UMC 817.81 Through 817.88 Coal Processing Waste Banks

The coal stockpile portion of the loading facility will be constructed on a coal processing waste bank. A plan for continued use of this waste bank was submitted to the Mine Safety and Health Administration in accordance with 30 CFR 77.215-2. M.S.H.A. has not determined this waste bank to be hazardous in accordance with 30 CFR 77.215-2 and has stated that no additional information or reports will be required unless further notified. Routine inspections of this pile have not be required by M.S.H.A.

A description of the refuse pile is given in Chapter XII of the Permit Application under Geotechnical Information. Appendices XII-6, 7 and 8 give geotechnical information for numerous test holes drilled in the refuse pile. These reports give detailed information on the nature and condition of material present in the pile. Exhibits III-3, III-14A and III-20A show the current dimensions of the pile. Exhibit III-20A, in particular, shows current dimensions (pre-construction contours) and proposed dimensions (post-construction contours). The volume of material present in the refuse pile is estimated to be approximately 350 acre-feet.

The waste bank is not influenced by ground water or leachate from acid or toxic-forming waste. All surface drainage from the area above the bank and from the crest and slopes of the bank is either diverted away from the bank or directed and contained by existing sediment control structures. There are no significant surface erosion effects presently existing on the outslopes. Re-shaping of outslopes during site preparation will further lessen the potential for erosion.

New construction and excavation on the waste bank will be carried out using recognized professional standards. No coal processing waste will be removed from the disposal area. The area will, however, be regraded to enhance the loadout facility and surface runoff containment. See Exhibit III-20A (post-construction contours) for proposed modifications

to the existing configuration. Waste material once removed and replaced will be spread in layers no more than 24 inches thick and compacted to attain 90 percent of maximum dry density in accordance with AASHTO specification T99-74. Geotechnical investigations have been undertaken to determine the nature and suitability of the waste material for construction purposes. See Appendices XII-6, 7 and 8. Results of these investigations have been provided to engineering design and construction bidders for foundation design purposes. Foundations for all load bearing structures will be designed in strict compliance with geotechnical recommendations.

The waste bank will be inspected on a quarterly basis by a person certified by M.S.H.A. to perform such inspections. The inspector will evaluate the potential hazard to human life and property, ensure that all organic material and topsoil have been removed and that proper construction and maintenance are carried out.

Should coal processing waste fires occur, they will be extinguished as described in our M.S.H.A. approved plan included in Chapter XII, Appendix XII-3.

UMC 817.89 Disposal of Non-Coal Wastes

All non-coal wastes will be disposed of in designated locations in accordance with our approved Non-Coal Waste Disposal Plan.

UMC 817.91 Through 817.93 Coal Processing Waste: Dams and Embankments

Does not apply.

UMC 817.95 Air Resources Protection

Fugitive dust will be controlled in accordance with Utah Air Conservation Regulations as adopted by the Utah State Board of Health. A

letter of intent to approve the coal storage and loadout facility was recieved from the State Department of Health on June 12, 1984.

Exposed surface areas will be protected and stabilized to effectively control air pollution resulting from erosion. Rills and gullies which form in areas that have been regraded and topsoiled and which disrupt the re-establishment of vegetative cover or contribute to a violation of water quality standards for receiving streams will be filled, regraded, topsoiled and reseeded.

UMC 817.98 Protection of Fish, Wildlife, and Related Environmental Values

The proposed loadout will be constructed in a previously disturbed portion of the permit area. The protection of fish, wildlife and related environmental values are discussed for the entire permit area in Chapter X of the Permit Application.

UMC 817.99 Slides and Other Damage

If a slide occurs which may have a potential adverse effect on public property, health, safety or the environment, the Division will be notified by the fastest available means. All remedial measures required by the Division will be complied with.

UMC 817.100 Contemporaneous Reclamation

Reclamation efforts, including backfilling, grading, topsoil replacement revegetation will be initiated as soon as practicable with mine operations.

UMC 817.101 Through 817.106 Backfilling and Grading

The proposed loadout will be constructed in a previously disturbed portion of the permit area. A plan for backfilling and grading this area is included in our Reclamation Plan.

UMC 817.106 Regrading or Stabilizing Rills and Gullies

See our Plan for backfilling, solid stabilization, compacting and grading included in the Permit Application.

UMC 817.111 Through 817.117 Revegetation

The proposed loadout will be constructed in a previously disturbed portion of the permit area. Plans for revegetating the area are discussed in the Permit Application.

UMC 817.122 Through 817.126 Subsidence Control

A subsidence control plan for the entire permit area is included in the Permit Application.

UMC 817.131 Through 817.132 Cessation of Operations

In the event of temporary cessation of operations associated with the loadout facility for a period of 30 days or more, the Division will be notified and the facilities will be secured, supported and maintained. The notice to the Division will include a statement of the exact number of surface acres which have been in the permit area prior to cessation and the kind of reclamation which will have been accomplished, and identification of the backfilling, regrading, revegetation, environmental monitoring and water treatment activities that will continue during the temporary cessation. At the time of permanent cessation of operations of all surface equipment, structures and other facilities not required, unless approved for postmining land use or environmental monitoring, will be removed and the affected lands reclaimed.

UMC 817.133 Postmining Land Use

Postmining land use for the land associated with the loadout facility

will be the same as the rest of the permit area, namely, livestock grazing and wildlife habitat. Land aasociated with the railroad underpass will not be reclaimed since it will become a permanent part of State Highway 122 which serves the town of Hiawatha.

Postmining maintenance of the underpass and highway will be assumed by the Utah Department of Transportation as noted in their concurrence letter of May 17, 1984. An agreement granting right of way to the State will be entered into upon completion of construction.

UMC 817.150 Through 817.176 Roads

No new roads are proposed to be constructed in connection with the loadout facility. Existing roads are discussed in the Permit Application.

UMC 817.180 Other Transportation Facilities

Transportation facilities associated with the proposed unit train loadout will be designed, constructed and maintained to prevent, to the extend possible using the best technology currently available, damage to fish, wildlife and related environmental values, and additional contrivutions of suspended solids to streamflow or runoff outside the permit area. Wildlife, environmental values and runoff containment are addressed for the site of this facility in appropriate sections of the Permit Application.

UMC 817.181 Support Facilities and Utility Installations

Support facilities used incidentally to the proposed loadout will be designed, constructed and maintained in a manner which prevents, to the extent possible using the best technology currently available, damage to fish, wildlife and related environmental values, and additional contrivutions of suspended solids to streamflow or runoff outside the permit area.

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

May 10, 1984

Mr. Brent C. Bradford, Executive Secretary
State of Utah, Dept. of Health
Division of Environmental Health
150 West North Temple
P.O. Box 2500
Salt Lake City, Utah 84110-2500

Re: Notice of Intent - U.S. Fuel Co.
Proposed Coal Loadout Facility

Dear Mr. Bradford;

In compliance with the Utah State Dept. of Health Air Conservation Regulations Section 3.1, United States Fuel Company is filing a Notice of Intent to construct a coal storage and loadout facility at their preparation plant in Hiawatha, Utah. This addition to the coal preparation plant installation will improve coal handling and loading efficiency. Enclosed to accompany the Notice of Intent is a narrative and two drawings. These are the most complete plan drawings to date.

As prescribed by Utah Air Conservation Regulations section 3.1.6, the following information is submitted:

3.1.6 (a) The nature of the process involved in the coal loadout facility is coal transfer. As shown by Drawing G-3 coal will come from the existing preparation plant by way of the existing No. 9 conveyor to an enclosed transfer tower. This conveyor will be modified to a convered 42 inch belt with a 1,075 ton per hour capacity. From the first transfer tower the coal will be put on another covered 42 inch, 1,075 tph belt that will take it to an enclosed pre-storage sampling tower. From here the coal will be transferred within the tower to another covered 42 inch 1,075 tph belt to a 42 inch shuttle conveyor and the coal stockpiles.

Each stockpile will have a storage capacity of 25,000 tons. The belt will dump into enclosed stacking tubes. Coal will flow from the appropriate level in the enclosed stacking tube onto the coal piles.

Drawing G-3 shows a third (future) coal pile. This pile is also to be included as part of the proposed coal handling facility. Coal storaged in this third pile will be delivered by haul trucks.

All of the coal piles feed into chutes beneath the coal piles. These chutes convey the coal to a 72", 3,000 ton per hour belt which runs beneath them. The 72" belt also runs beneath the previously described third coal pile and leads to the coal loadout unit that feeds into the rail cars as they pass under it.

3.1.6 (b) Basically coal traveling thru this system will be that needed to fill contracts having specific quality specifications. The size of the coal will be primarily 1 5/8 inch by 0 with a moisture range between 9.4 and 11%. All coal traveling through the system will be on covered conveyor. Coal transfer will occur within enclosed structures.

The particle size of the third coal pile would be toward the smaller range but would have a higher moisture content, usually in the 11 to 12 percent range. The number of truck runs to the pile averaged over a month would be ten trips per day on unpaved roadway. (Dust on the unpaved roadway is suppressed by water sprayed by a water truck.) The one mile round trip route would be traveled by 15 ton, diesel dump trucks.

3.1.6 (c), (d) and (e) Unapplicable

3.1.6 (f) The coal pile conveyor lines would be active during the normal working hours of the preparation plant. This would average about 16 hours a day, 19 - 20 days per month. However, the train loadout unit would operate only when a train was to be loaded. This would amount to about 12 hours per week for one to two 80 car unit trains.

3.1.6 (g) United States Fuel Company wishes to begin construction on the stockpile and loadout system July 1, 1984. Earth work and foundation preparation is expected to take three months with concrete, structural, mechanical and electrical work taking from six to eight months longer. The system must be in operation by September, 1985.

3.1.6 (h) The total length of the new conveyor system will be 1,363 feet. All of this conveyor line will be covered or enclosed. The new system will contain four transfer points, all of which would be within enclosed structures.

Stockpiled coal will be located on three piles adjacent to one another. Two 25,000 ton piles will have approximate dimensions of 81 feet high and 230 feet in diameter. The third pile of 10,000 tons will be 56 feet high and 60 feet in diameter. The average slope on the piles will be 35 degrees.

The maximum amount of coal that could be transferred

to the coal stockpiles would be 1,075 tph. As this rate is considerably higher than what the preparation plant can wash per hour, it is unlikely that greater than 50 percent capacity will be used regularly.

The maximum amount of coal that could be transferred from the coal stockpiles to the train loading unit would be 3,000 tph.

Dust control measures are not proposed for coal transfer points because they are enclosed within towers, tunnels or stacking tubes. Little if any dust should be emitted from these locations.

The coal stockpiles are not expected to be significant source of dust. The coal in the two large piles will contain a minimum of 9.4 percent moisture, while the third smaller pile should range from 10 to 12 percent moisture.

The new coal stockpile and loadout system is expected to transfer one million tons of washed coal per year. No critical pollutants will be likely to issue from the conveyor line or the loadout facility as all of the belt drives and bin feeders will be run electrically.

No change is expected in vehicle miles due to the implementation of stockpile and loadout facility. Vehicular traffic most probably will be reduced due to utilization of a system more efficient than is presently operating. Much of the washed coal is now trucked to stockpiles and loadout locations. The new system will eliminate many vehicle miles on dirt road when all of the coal to be shipped or stockpiled can be handled by a conveyor belt.

Normal dust suppression on dirt roadways with water spray will continue to be used during construction and use of the coal stockpile and loadout facility.

Sincerely,

Robert Eccli

Robert Eccli
Sr. Mining Engineer

RE:lj

Enclosure:

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

May 15, 1984

Carbon County Engineering Department
District Four Office
Carbon County Courthouse
Price, Utah 84501

Dear Gentlemen:

United States Fuel Company, through this notification, seeks to inform all affected parties of their intent to construct a unit train coal loadout facility at their present operations in Hiawatha, Utah. Due to the fact that unit trains (approximately 80 cars) will be loaded by this new facility, it is necessary to relocate the present railroad crossing of Highway 122 in the town of Hiawatha to avoid road blockage.

The crossing is to be redesigned as an underpass to allow traffic to freely move under the tracks. Construction of the underpass will occur approximately 550 feet south of the present crossing.

Construction of the loadout facility and accompanying underpass is scheduled to begin in July of 1984. Enclosed is a copy of the general layout and design. We are requesting approval from your Department to construct the proposed underpass.

Please contact me at 343-2471 or 637-2252 should furthur information be desired.

Sincerely,

Robert Eccli

Robert Eccli
Senior Mining Engineer

Enclosure

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

May 15, 1984

Utah Highway Department
District Four Office
Price, Utah 84501

Dear Gentlemen:

United States Fuel Company, through this notification, seeks to inform all affected parties of their intent to construct a unit train coal loadout facility at their present operations in Hiawatha, Utah. Due to the fact that unit trains (approximately 80 cars) will be loaded by this new facility, it is necessary to relocate the present railroad crossing of Highway 122 in the town of Hiawatha to avoid road blockage.

The crossing is to be redesigned as an underpass to allow traffic to freely move under the tracks. Construction of the underpass will occur approximately 550 feet south of the present crossing.

Construction of the loadout facility and accompanying underpass is scheduled to begin in July of 1984. Enclosed is a copy of the general layout and design. We are requesting approval from your Department to construct the proposed underpass.

Please contact me at 343-2471 or 637-2252 should furthur information be desired.

Sincerely,

Robert Eccli

Robert Eccli
Senior Mining Engineer

Enclosure

KING COAL

Director
William D. Hurley, P.E.

Assistant Director
Gene Sturzenegger, P.E.

District Four Director
Sterling C. Davis, P.E.

UTAH DEPARTMENT OF TRANSPORTATION
P.O. Box 'R'
Price, Utah 84501

May 17, 1984

United States Fuel Company
Attn: Mr. Robert Eccli
Hiawatha, Utah 84527

Ref: May 15, 1984 - Relocation, Highway 122

Dear Sirs:

This office has reviewed your plan relocation of Highway 122 in the town of Hiawatha. We find no problems with the relocation. Prior to our final concurrence of this construction, we would want to review your final plans and enter into proper agreements for this relocation of Highway 122.

Respectfully,

L. Archie Hamilton
District Preconstruction Engineer

LAH:jvz

cc: Sterling C. Davis, PE

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

July 11, 1984

Mr. Allen D. Klein
Administrator, Western Technical Center
Office of Surface Mining
Brooks Towers
1020 15th Street
Denver, Colorado 80202

Dear Mr. Klein;

This submittal is in response to your letter of June 15, 1984 relating to additional information required for review of our proposed unit train loading facility. Seven copies of the following information is provided as per your letter:

1. UMC 782.19 IDENTIFICATION OF OTHER LICENCES AND PERMITS

   A list of licenses and permits required to construct and operate the loading facility is included with this submittal. MSHA has been notified of our intent to modify the refuse pile and their comments have been requested. See letter enclosed.

2. UMC 783.12 GENERAL ENVIRONMENTAL RESOURCES INFORMATION

   There is a typographic error in the operational date listed in the Operation Plan. A revised Operation Plan is included with this submittal.

   U.S. Fuel intends to construct only those facilities described in the Operation Plan. No preparation plant or thickener facility is being proposed in this application.

3. UMC 783.24 (b) MAPS: GENERAL REQUIREMENTS

   The unit train loadout silo (to be located on Utah Railway property) has not been included in the U.S. Fuel property disturbed area because the property does not belong to U.S. Fuel. To include this in the disturbed area boundary would imply that U.S. Fuel intends to reclaim the strip of railroad. This is not the case. U.S. Fuel will, at the time of final reclamation, dismantle and remove loadout structures from Utah Railway property. This is covered in section UMC 786.19 (a) UNIT TRAIN LOADOUT.

4. UMC 784.11 OPERATION PLAN: GENERAL REQUIREMENTS

Pre-construction and post-construction topographic views of the proposed unit train loading facility are given on Exhibit III-20A. Existing access roads shown on Exhibit III-20A do not conflict with existing roads shown on Exhibit III-3. The existing road just west of the railroad tracks will remain in place after construction has been completed as shown by "post construction contours" on Exhibit III-20A. We do not propose to construct new roads to access this facility.

We feel that Exhibits III-19, 20 and 21 provide sufficient detail to calculate a bond. We assume that bond estimates will be made by a qualified estimator familiar with structural design. Final detailed drawings can not be prepaired until a contract is signed with a selected engineering design and construction contractor. We can not grant a contract to design and construct a facility without having an approved permit. Again, we feel that sufficient detail is provided for an experienced estimator to make reasonable bonding estimates.

The Operation Plan has been revised to clarify misunderstandings. Additional geotechnical reports are included (Appendix XII-7 and XII-8). These reports describe pertinent foundation information, however, review personnel should be advised that since these investigations were performed several years ago some information may be included for facilities which are not part of our current proposal.

5. UMC 784.12 (a) and (b) OPERATION PLAN: EXISTING STRUCTURES

The Compliance Plan has been revised to clarify misunderstandings and provide additional information requested under this part.

A topsoil removal and storage plan for the proposed highway underpass will be included in our revised soils information submittal due July 20. The Reclamation Plan for the loadout area will also be addressed in that submittal.

A plan for control of air pollution under UMC 817.95 (revised in CFR Part 817, January 10, 1984) is given in the Compliance Plan.

6. UMC 784.13 (1) (2) (3) RECLAMATION PLAN: GENERAL REQUIREMENTS

Exhibits III-19, 20 and 21 give details of the proposed unit train loadout facility. We assume OSM realizes that specific construction details of the towers and silo can not be specified until a selected design and construction firm is granted a contract to begine work on the project. We cannot grant a contract until we have approval to build the facility. U.S. Fuel will accept a

reasonable bond estimate based on similar loadouts and the drawings we have provided.

7. UMC 784.15 RECLAMATION PLAN: POSTMINING LAND USE

The Compliance Plan has been revised to show that the State will assume postmining maintenance responsibility for the highway and underpass.

8. UMC 784.26 AIR POLLUTION CONTROL PLAN

An Air Pollution Control Plan has been submitted to the State of Utah Department of Health. A letter of intent to approve the Plan was received from the Department of Health on June 12, 1984. See copy enclosed.

Item UMC 817.95 AIR RESOURCES PROTECTION of the Compliance Plan has been revised to provide measures proposed for control of air pollution.

9. UMC 784.18 RELOCATION OF USE OF PUBLIC ROADS

A letter has been sent to the Board of Oil, Gas, and mining (copy enclosed) notifying them of our intent to relocate the road. Carbon County has not yet replied to our letter of intent.

Sincerely,

Robert Eccli

Robert Eccli
Sr. Mining Engineer

cc: James W. Smith
D.O.G.M. w/copies

Enclosures

RE:lj

UMC 782.19 IDENTIFICATION of LICENSES and PERMITS

For

UNIT TRAIN LOADING FACILITY

Permit	Permitting Agency	Status of Permit
Air Quality Permit No Identification Number	State of Utah Dept. of Health 150 West North Temple Salt Lake City, Utah 84110	Intent to Approve Issued 06-12-84
Highway Relocation Permit	Utah Dept. of Transportation District 4 Office Price, Utah 84501	Letter of Concurrence Received May 17, 1984
Refuse Pile No. 1 I.D. No. 1211-UT-9-0007	Mine Safety & Health Administration P.O. Box 25367 Denver, Colorado 80225	Approved 04-08-76
Railway Approval	Utah Railway Company 136 East South Temple Salt Lake City, Utah 84111	Letter of Concurrence Received 05-22-84
County Approval	Carbon County Engineering Dept. Carbon County Courthouse Price, Utah 84501	Letter of Intent Submitted May 15, 1984

STATE OF UTAH
DEPARTMENT OF HEALTH

SCOTT M MATHESON, GOVERNOR

MICHAEL J STAPLEY, M.P.A., ACTING EXECUTIVE DIRECTOR

June 12, 1984
533-6108

Robert Eccli
U.S. Fuel Company
Hiawatha, Utah 84527

RE: Intent to Approve Coal Storage and Loadout, Carbon County

Dear Mr. Eccli:

Plans and specifications for your proposal to construct a coal storage and loadout in Carbon County have been evaluated and have been found to be consistent with the requirements of the Utah Air Conservation Regulations (UACR) and the Utah Air Conservation Act.

The Executive Secretary will publish notice of intent to issue an approval order in the Salt Lake Tribune and Deseret News on June 15, 1984. A 30-day period following the publishing date will be allowed during which your proposal and the Executive Secretary's evaluation of the impact on air quality will be available for review and comment. If within 15 days of publication of notice anyone so requests, a hearing will be held.

Unless modified, the approval order would be based upon the following operating conditions:

1. All emission control equipment shall be properly installed, maintained, and operated as proposed in the notice of intent dated May 10, 1984.

2. No visible emissions from any point shall exceed 20% opacity as measured by EPA Test Method 9.

3. All three storage piles shall be built around stacking tubes. They shall be water sprayed to minimize fugitive dusts as dry conditions warrant or as determined necessary by the Executive Secretary. The coal piles shall use feed chutes beneath them which convey the coal to a conveyor belt which runs beneath the piles. This belt shall lead to the loadout silo.

4. All conveyors shall be covered or enclosed. The four transfer points shall be enclosed.

5. The unpaved haul road shall be water sprayed at least twice per eight hour shift unless daily precipitation exceeds 0.05 inches for that day.

6. The unit train loadout silo shall be equipped with a telescoping chute or equivalent device to minimize the drop distance of the coal.

7. The Executive Secretary shall be notified when startup of the loadout silo occurs as an initial compliance inspection is required.

All comments received during the 30-day period and from any hearing held will be considered by the Executive Secretary before an approval is issued. You may not proceed with any of the proposed construction of the air pollution sources or control facilities until you have received an approval from the Executive Secretary. No PSD permit is required for this source.

The Bureau of Air Quality is authorized to charge a filing fee and be reimbursed for the actual costs incurred in reviewing your proposed project and issuing an approval order. The costs will be itemized in the final order and are payable to the Utah State Department of Health, sent to the Executive Secretary, Utah Air Conservation Committee, within 30 days after receipt of the order.

Sincerely,

for Burnell Cordner
Brent C. Bradford
Executive Secretary
Utah Air Conservation Committee

DK/ads
cc: Southeastern District Health Dept.
0641

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

June 15, 1984

Mr. John W. Barton
District Manager
Mine Safety and Health Administration
P.O. Box 25367
Denver, Colorado 80225

Dear Mr. Barton;

Enclosed, please find information relating to U.S. Fuel Company's proposal to construct a unit train loading facility at Hiawatha, Utah.

This information has also been sent to the Office of Surface Mining as part of our Mining and Reclamation Plan. OSM has requested that we send a copy to your office for review and comments particularly in regard to use of refuse pile No. 1, I.D. No. 1211-UT-9-0007.

Sincerely,

Robert Eccli

Robert Eccli
Sr. Mining Engineer

RE:lj

cc: Sarah Bransom, O.S.M.

KINGCOAL

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

July 9, 1984

Ms. Marjorie L. Larson
Secretary of the Board
Board of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84114

Dear Ms. Larson:

United States Fuel Company is proposing to construct a unit train loading facility on company property near Hiawatha, Utah.

Plans for this facility have been submitted to DOGM and OSM and are currently under review in connection with our Mining and Reclamation Plan approval.

Part of the plan for the loading facility includes a railroad underpass and relocation of State Highway 122. See Exhibit III-19 enclosed.

This letter is to notify you of our proposal to relocate the highway so that the Board can initiate public participation requirements as required by UMC 761.12 (d). The Utah Department of Transportation has inidcated concurrence with our proposal. See letter attached.

Sincerely,

Robert Eccli

Robert Eccli,
Sr. Mining Engineer

RE/ds

Attachment:

KING COAL

Can't Find these Reports

Important: Add two "Soils and Foundation Investigation" reports (Nov. 1978 and March 1979 , Rollins, Brown and Gunnell, Inc.) from the back of the Nov. 7, 1983, Vol. 1, Permit Application here.

SOILS AND FOUNDATION INVESTIGATION

U. S. FUEL
COAL HANDLING FACILITIES
HIAWATHA, UTAH

NOVEMBER 1978

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS
1435 WEST 820 NORTH, P.O. BOX 711, PROVO, UTAH 84601

FORM CO. 689 1M 8-61

CALCULATION SHEET

UNITED STATES FUEL COMPANY
ENGINEERING DEPT., HIAWATHA, UTAH

COMPUTATION FOR TEST HOLE COORDINATES FOR FOUNDATION INVESTIGATIONS

REF. DRAWING

INDEX NO. SHEET NO.
PLACE
JOB
DATE
COMPUTED BY
CHECKED BY
REVISED

HOLE NO.	COORDINATES		COLLAR ELEV.
1	S. 656	W. 118	7186.1
2	S. 854	E. 15	7179.9
3	S. 564	W. 180	7188.4
4	S. 1026	E. 135	7149.1

No storage ponds or other water bodies are located in the immediate vicinity of the facilities at this location which would influence the groundwater level throughout the site.

The vegetative cover throughout the area is relatively sparse and presents no technical problems at this location.

Aside from the coal preparation plant, no buildings are located in the immediate vicinity of the proposed facilities from which foundation performance can be inferred.

Other than the information provided above, no environmental conditions appear to exist at this site which would adversely affect foundation performance.

2. Subsurface Soil and Water Conditions

The subsurface material at the site was investigated by drilling 8 test borings at the approximate locations as shown in Figure No. 1. Test borings No. 1, 2, 3 and 4 were drilled in the vicinity of the raw coal pile and the washed coal pile. Holes No. 1 through No. 3 were drilled to a depth of approximately 60 feet to determine the depth of the refuse material throughout the site and to define the characteristics of the material below the bottom of the refuse in the event that deep foundations would be required for the proposed facility. Test hole No. 4 was drilled in the vicinity of the future coal pile and was extended through the refuse material into the natural soils. The borings logs from holes No. 1 through No. 4 are presented in Figures No. 2 through No. 4.

It will be observed that the refuse material extended to a depth of between 38 and 41 feet below the existing ground surface for test borings No. 1 through No. 3. Test boring No. 4 which was drilled at the proposed site of the future coal pile indicated a refuse depth of approximately 11 feet. The subsurface soils beneath the refuse material consisted of granular-type soils except for a few feet of silty clay or sandy silt which existed in test holes No. 1, 2 and 3.

In test holes No. 5 and No. 6, the subsurface soil profile generally consisted of a surface layer of coal refuse 1 foot to 5 feet in thickness underlain by granular-type material. Some silt existed below the black coal refuse in test boring No. 6. It will be noted that these two test borings were drilled to a depth of approximately 15 feet.

Test borings No. 7 and No. 8 were extended to a depth of 10 feet below the ground surface and it will be observed from the boring logs that a light brown sandstone is capped by approximately 3 feet of sandy silt.

During the subsurface investigation, sampling was performed at approximately 5-foot intervals throughout the depth investigated. Samples were obtained by driving a 2-inch split-spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling spoon through each 6 inches of penetration is presented on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. It should be noted that the standard penetration value provides a reasonable indication of the in-place density of sandy-type soils; however, considerable care must be used in deducing in-place densities from standard penetration tests in coarse granular material. In material in which the particle size is substantially greater than the inside diameter of the spoon, particles frequently lodge in the point of the spoon and the standard penetration value simply represents the energy required to drive a particle through the subsurface material. If a reasonable amount of material is recovered in performing standard penetration tests in sands and if the standard penetration spoon can penetrate the entire 18 inches of depth, some reliability can be placed on the results of these tests.

The results of the standard penetration tests performed in all of the refuse material at the proposed location indicate that many loose areas exist throughout this material and it is our opinion that this material is not capable of supporting high load intensities without adverse settlement.

The in-place density of the natural material below the refuse material in all test borings performed at the site indicates that this material is in a medium to dense condition and is capable of supporting substantial load intensities. The sandstone encountered in test borings No. 7 and No. 8 is weakly cemented; however, it is capable of supporting medium to high load intensities. Each sample obtained in the field was classified in the laboratory in accordance with the Unified Soil Classification System shown in Figure 7. No groundwater was encountered in any of the test borings drilled at this site and it is our opinion the neither shallow nor deep foundations constructed at this site will be influenced by groundwater throughout this area.

3. Foundation Considerations

As indicated earlier in this report, the coal handling facilities include the raw coal pile, the washed coal pile, a concrete storage silo, a preloading scale and a 48-inch conveyor. The plant layout is generally as shown in Figure No. 1.

A. Washed Coal Storage Pile

It is our understanding that the washed coal storage pile will be 230 feet in diameter and 81 feet high and that the total load will be approximately 25,000 tons. The exact nature of the loadout facilities beneath the washed coal pile is not known as of the preparation of this report. It is assumed, however, that a concrete box approximately 18 feet square and 14 feet high will be located at the bottom of the clean coal pile and that a circular concrete stack approximately 14 feet in diameter will rise from the box and extend to the top of the coal pile. We also understand that a tunnel will run from the edge of the coal pile both ways and that this tunnel may be as large as 18 feet in diameter. Test borings No. 1 and No. 3 define the characteristics of the material at the washed coal pile. It will be noted from the boring logs that the refuse varies in thickness from about 38 to 40 feet below the ground surface at this location.

The results of the drilling indicate that the refuse at this location is relatively loose at a number of locations throughout the soil profile, and it is our opinion that this material is not capable of supporting high load intensities. In providing foundation recommendations for this facility, consideration has been given to supporting the concrete structures throughout the washed coal pile using spread footings on natural material, spread footings on compacted fill or pile foundations.

(1) Spread footings on existing material

Based upon the information described above, it appears as if the foundations for the concrete facilities beneath the coal pile will be located in the vicinity of 14 feet below the existing ground surface. Since the refuse material is relatively loose at many places throughout the profile, it is anticipated that settlement will occur in these materials when the coal pile is placed throughout the area. Furthermore, it is anticipated that the settlement will occur in a differential manner throughout the facilities. If the concrete box supporting the circular tower is supported directly on spread foundations, an allowable soil bearing pressure of not greater than 2000 pounds should be used. It is likely, however, that the settlement of this facility may result in some differential cracking of the box as well as the tunnel running both ways through the coal pile.

Because of the uncertainty associated with the performance of the refuse material under the contemplated loads at this site, we do not recommend that the proposed facilities be supported on spread foundations.

(2) Spread foundations on compacted fill material

Some of the uncertainty associated with supporting the concrete structures in the washed coal pile directly on the refuse material could be eliminated if the refuse material were excavated and replaced with compacted fill. The depth of the compacted fill should extend below the bottom of the footings for a depth at least equal to the width of the footings. Since a substantial portion of the zone of significant stress would exist within the compacted fill, it is anticipated that possible differential settlement throughout the structure would be reduced. If the structures are supported using spread footings on compacted fill, an allowable soil bearing pressure of 4000 pounds per square foot should be used. It should be noted, however, that approximately 20 feet of refuse material would still exist beneath the compacted fill and some settlement could occur in this material due to the overall loads associated with the clean coal pile.

While placing the foundations on compacted fill as indicated above would reduce some of the uncertainty associated with differential settlement throughout the structures, it is our opinion the some differential settlement could still occur because of the loose material in the refuse material below a depth of 20 feet.

(3) Pile Foundations

Because of the uncertainty of the foundation performance under the contemplated loads for the clean coal pile, it is our opinion that pile foundations extending to the granular material in the area beneath the refuse represents the most stable type of foundation to support the proposed facility.

As indicated earlier in the report, the granular material beneath the refuse is in a relatively dense state and is capable of supporting substantial load intensities.

In order to proportion the foundations for the proposed facilities using pile foundations, estimated pile capacities for various tip diameters have been prepared using static formulas. Recommended pile capacities for various tip diameters are outlined below.

	Pile Diameter	Pile Capacity
Length of Pile =35'	10"	36
	12"	43
	14"	57
	16"	73

In preparing the above recommendations, it has been assumed that the piles would have a uniform diameter; however, the table is generally applicable for tapered piles, such as Raymond Step Taper piles.

It is recognized that the cost of pile foundations will be substantially greater than the other two foundation types considered for the proposed facility. It is our opinion that the final selection of the foundation type to support the proposed structures should be based upon the desired risk as well as the actual costs associated with the foundation type. It is entirely possible that foundations supported on compacted fill, as indicated above, will be entirely satisfactory. However, the risk associated with foundation performance for this foundation type is worse than the risk associated with pile foundations. It is our opinion that no problems will occur if the proposed facility is supported on piles extending to the granular layer beneath the refuse material.

B. Raw Coal Storage Pile

It is our understanding that the raw coal storage pile will be 230 feet in diameter and 81 feet high with a total load of 25,000 tons. We also understand that the handling facilities, including tunnel, concrete box and riser pipe will be similar to those contemplated for the washed coal pile. The subsurface material throughout the soil profile at this location is defined by test boring No. 1. It will be noted from the boring logs that the subsurface material throughout the profile in the vicinity of the raw coal storage pile is essentially the same as the subsurface material at the washed coal pile.

Since the concrete facilities beneath the coal pile are essentially the same as those for the washed coal pile and since the subsurface profile is essentially the same, we recommend that the foundation recommendations discussed for the washed coal pile be applicable to this facility.

C. Concrete Storage Silos

We understand that the concrete storage silo will be 75 feet in diameter and 200 feet high with a total capacity of 12,000 tons. Since the storage silo will be connected directly to the 48-inch diameter conveyor, it is assumed that this facility will be relatively sensitive to differential settlement.

If a mat foundation equal to the diameter of the silo is used to support the proposed facility, it is apparent that the loading intensity due to the 12,000 ton load will be approximately 3 tons per square foot. It appears likely that the dead weight of the silo will not exceed one ton per square foot which would result in a total load intensity for this facility of somewhere between 3 and 4 tons per square foot.

The characteristics of the subsurface material at this location are defined by test borings No. 5 and No. 6. The subsurface silts in the upper 6 to 9 feet of the soil profile at this site are not capable of supporting the proposed facility using a mat foundation and we recommend that the bottom of the foundation for the proposed facility either be located on the granular material in the lower portion of the profile at this site or that silt material be excavated and replaced with compacted granular material. If the silt is replaced with compacted granular material, the diameter of the compacted fill should be at least 1.75 times the diameter of the mat foundation.

The results of bearing capacity calculations indicate that the allowable soil bearing pressure of the existing granular material should not exceed 2.5 tons per square foot and the diameter of the mat should be selected accordingly if the mat is located on the natural granular materials. It should be noted that the test borings No. 5 and No. 6 were only extended to a depth of 15 feet below the existing ground surface. Since the zone of significant stress will extend to a substantial depth below the existing ground surface, we recommend that an additional boring be performed at this location to a depth of at least 60 feet below the existing ground surface.

D. Alternate Site Conditions

Test borings No. 7 and No. 8 were drilled at an alternate site for the washed coal pile and the raw coal pile. Since weakly cemented siltstone or sandstone was encountered at a depth of approximately 3 feet below the existing ground surface, these two borings were terminated at a depth of 10 feet below the existing ground surface. The material at these 2 locations was in a weakly cemented conditions; however, it appeared to be capable of supporting substantially greater loads than the refuse material.

Because of the relatively loose characteristics of the refuse material and the need for pile foundations to support structures in the vicinity of borings No. 1 through No. 3, it appears to us that locating the washed coal pile and the raw coal pile in the vicinity of test borings No. 7 and No. 8 may eliminate the necessity of pile foundations. If further consideration is given to locating the facilities in the vicinity of test holes No. 7 and No. 8, we recommend that further drilling be performed at this location to verify the character of the bedrock throughout a depth of at least 30 feet. In order to properly evaluate the bedrock, test borings in this area should be cored continuously throughout the depth investigated.

4. Site Preparation, Compacted Fill Requirements and Lateral Earth Pressures

It is not anticipated that an appreciable amount of surface grading will be required throughout this area to establish the final grade for the

proposed facility. It is contemplated, however, that substantial excavation and backfilling will be required to construct the tunnels and other operating facilities beneath the raw coal storage pile and the washed coal pile. It is also apparent that excavation will be required in the vicinity of the storage silo if the facility is located on the granular material at approximately 6 to 9 feet below the existing ground surface. If the storage silo is located on compacted fill, we recommend that the compacted fill for this facility consist of a well-graded granular material with a maximum size less than 4 inches and with not more than 15 percent passing a 200 sieve. The compacted fill should be densified to an in-place unit weight equal to 95 percent of the maximum laboratory density as determined by ASTM D 1557-70.

All backfill surrounding the tunnel and the other operating facilities for the raw coal pile and the washed coal pile should be densified to an in-place unit weight equal to 90 percent of the maximum laboratory density specified above.

In designing the concrete box and tunnel beneath the clean coal pile, we recommend that the structure be designed using the full weight of the overburden on top of the concrete box and a lateral earth pressure equal to 0.45 times the vertical pressure.

If the storage silo is located on the granular material and if passive earth pressures are utilized in stability computations for this facility, we recommend that a passive earth pressure coefficient of 4 be used in the following formula:

$$P_p = K_p \gamma \frac{H^2}{2}$$

where P = the total passive earth pressure
K_p = the passive earth pressure coefficient
γ = the unit weight
H = the height of the excavation

We recommend a value of 105 pounds per cubic foot be used for the unit weight in the above equation.

5. The Results of Field and Laboratory Tests

Field and laboratory tests performed during this investigation consisted essentially of standard penetration tests and mechanical analysis. The standard penetration tests are shown on the boring logs and the results of the mechanical analysis performed for test holes No. 1 and No. 2 are presented in Table No. 1, Summary of Test Data.

It will be observed that the granular material below the refuse is relatively clean and generally possesses less than 10 to 15 percent of the material in the silt and clay-size range. It is also noted that the material in the gravel-size range is the dominant textural size.

Friction angles and unit weights used in calculating the allowable pile capacities are also presented in the Summary of Test Data on Table No. 1.

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which, in our opinion, define the characteristics of the subsurface material at this site. It should be noted that recommendations for future investigations have been made throughout the report and that foundation recommendations included herein are based upon the completion of these additional investigations.

If there are any questions relative to the information contained herein, please advise us.

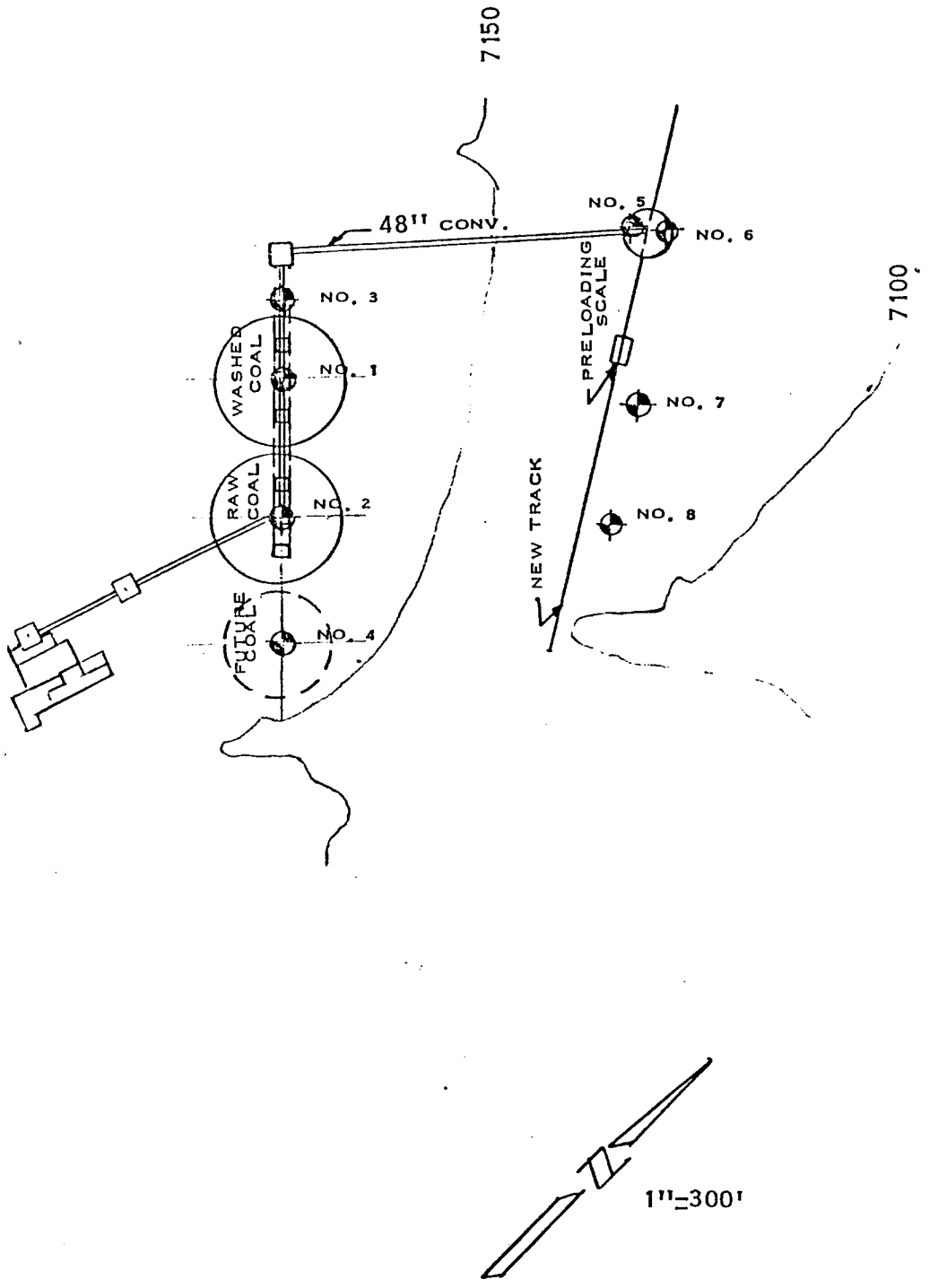
Yours truly,

Rollins, Brown and Gunnell, Inc.

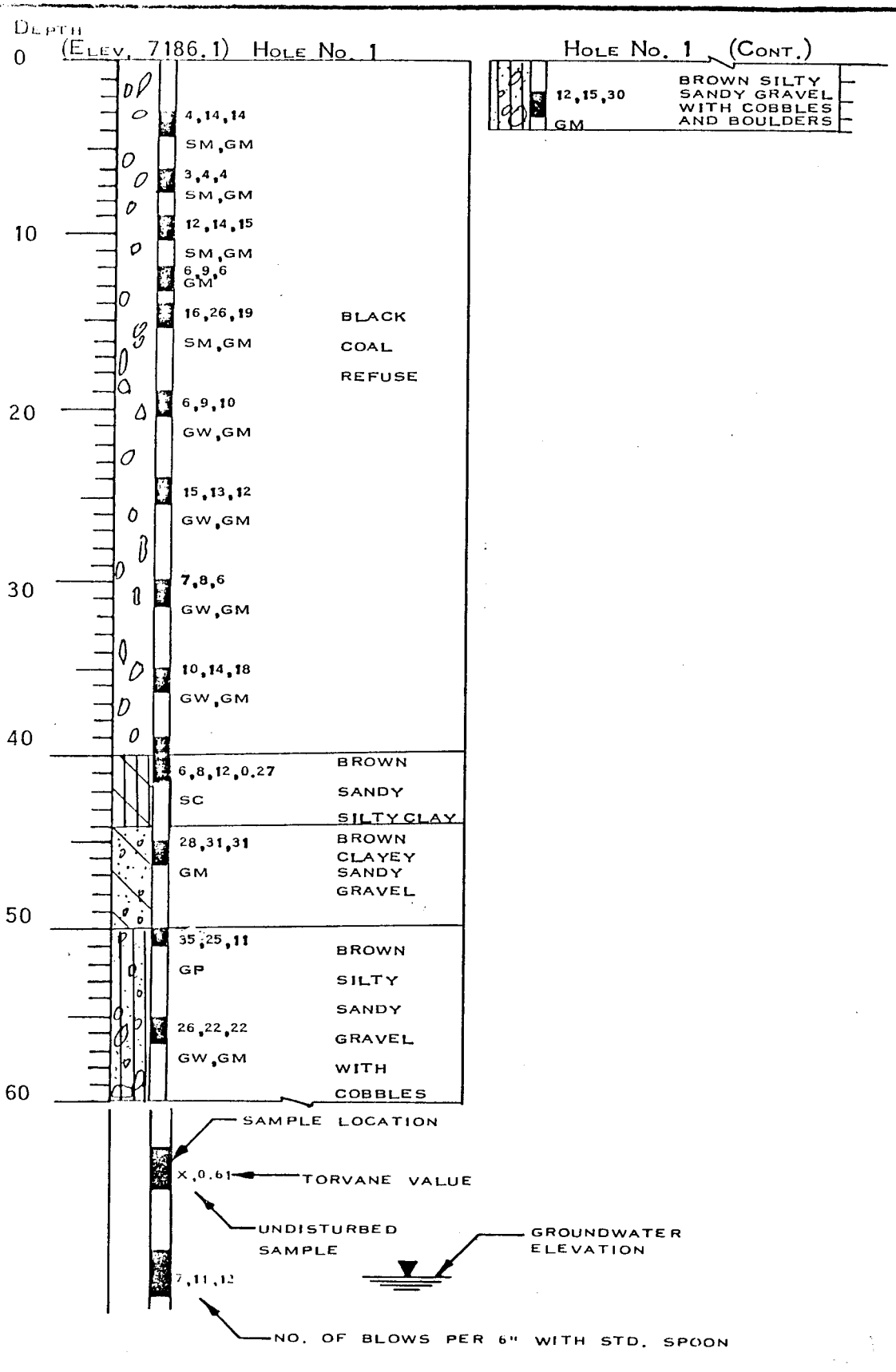
Ralph L. Rollins

Ralph L. Rollins

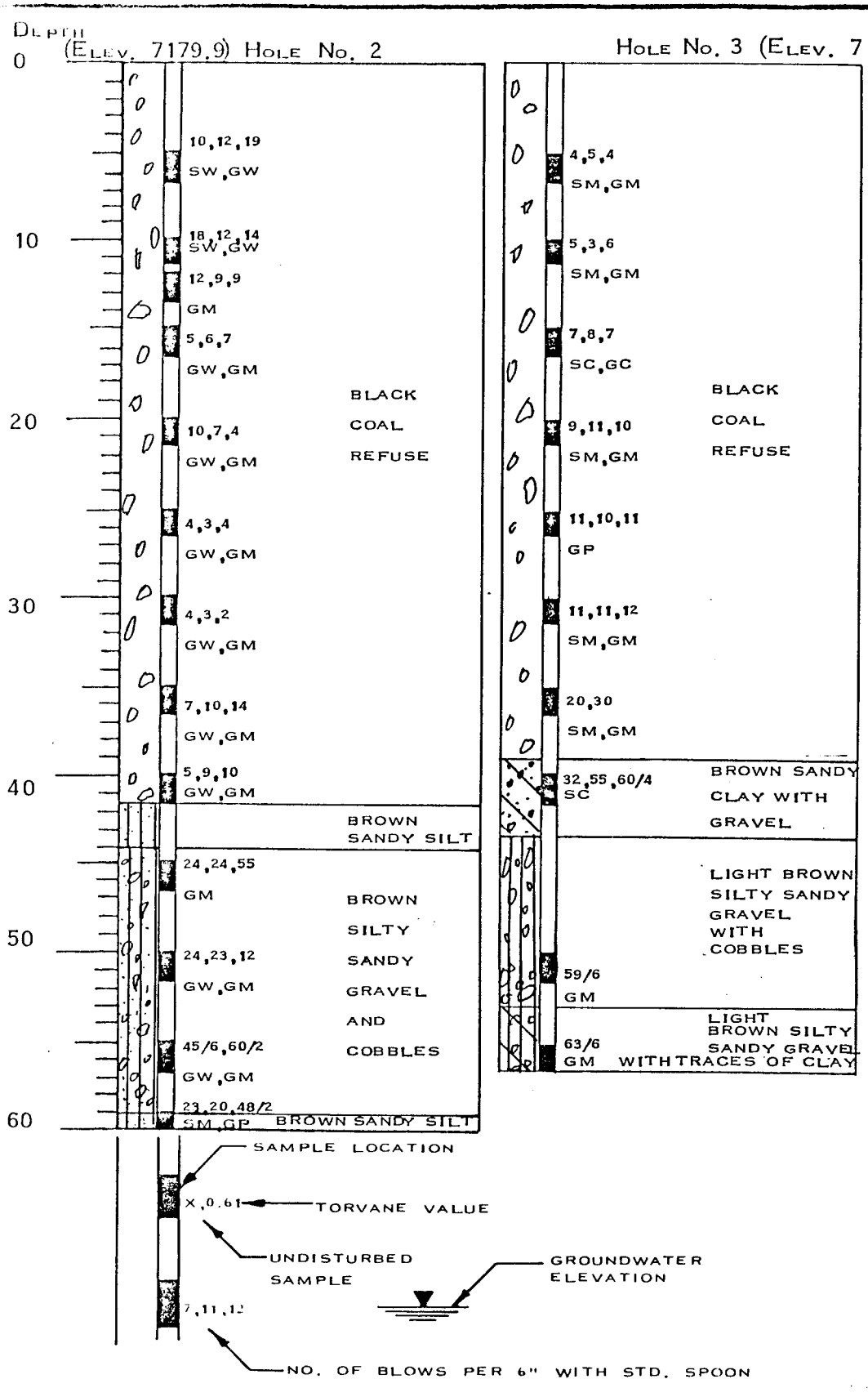
DMK
Enclosures



ROLLINS, BROWN & GUNNELL, INC. **CONSULTING ENGINEERS**	LOCATION OF TEST HOLES FOR THE U. S. FUEL COAL HANDLING FACILITIES, HIAWATHA, UTAH	FIGURE NO. 1

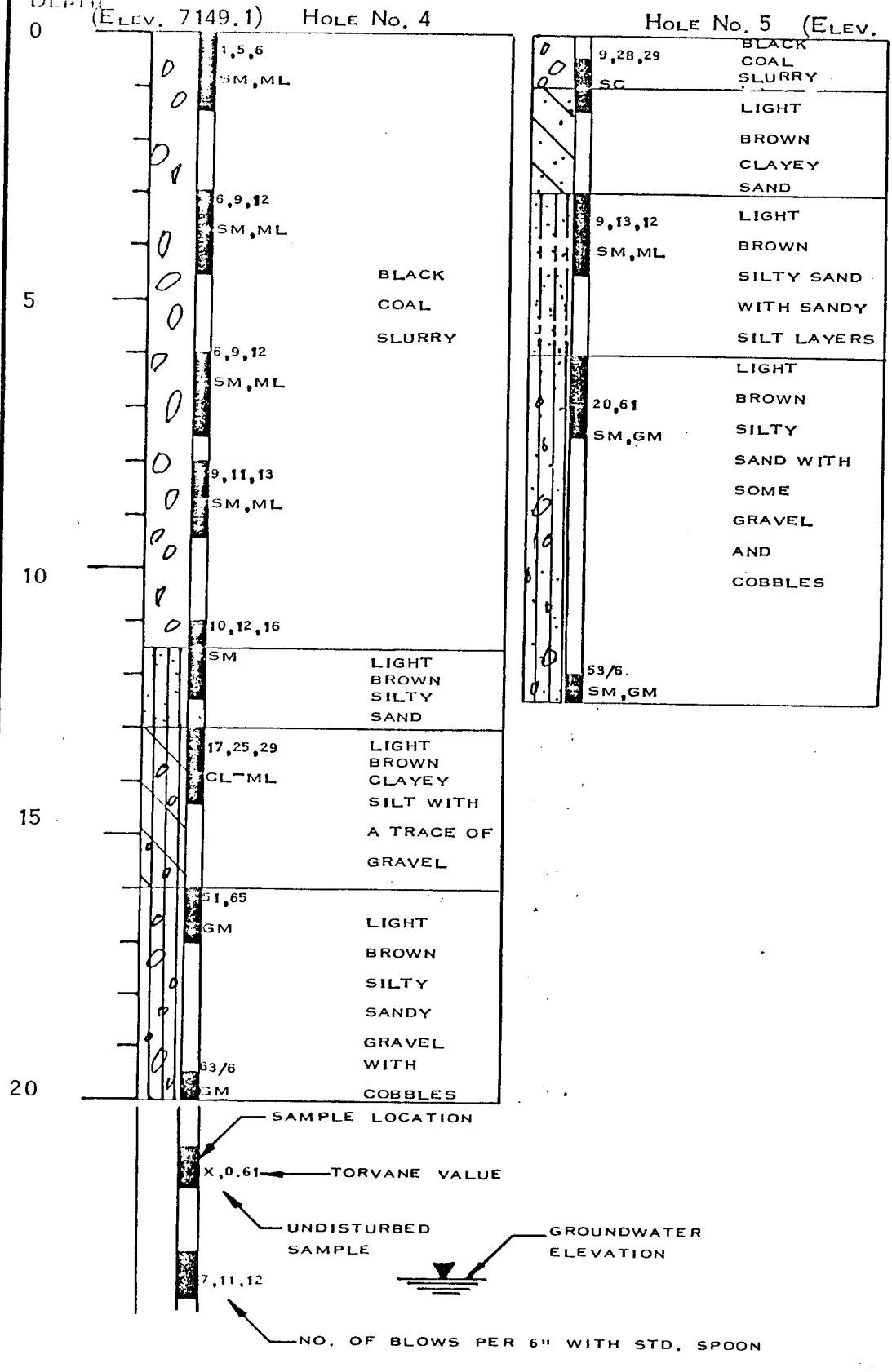


LOG OF BORINGS FOR: U. S. FUEL	ROLLINS, BROWN AND GUNNELL, INC. CONSULTING ENGINEERS	FIGURE NO. 2



LEGEND

LOG OF BORINGS FOR: U.S. FUEL	ROLLINS, BROWN AND GUNNELL, INC. CONSULTING ENGINEERS	FIGURE No. 3



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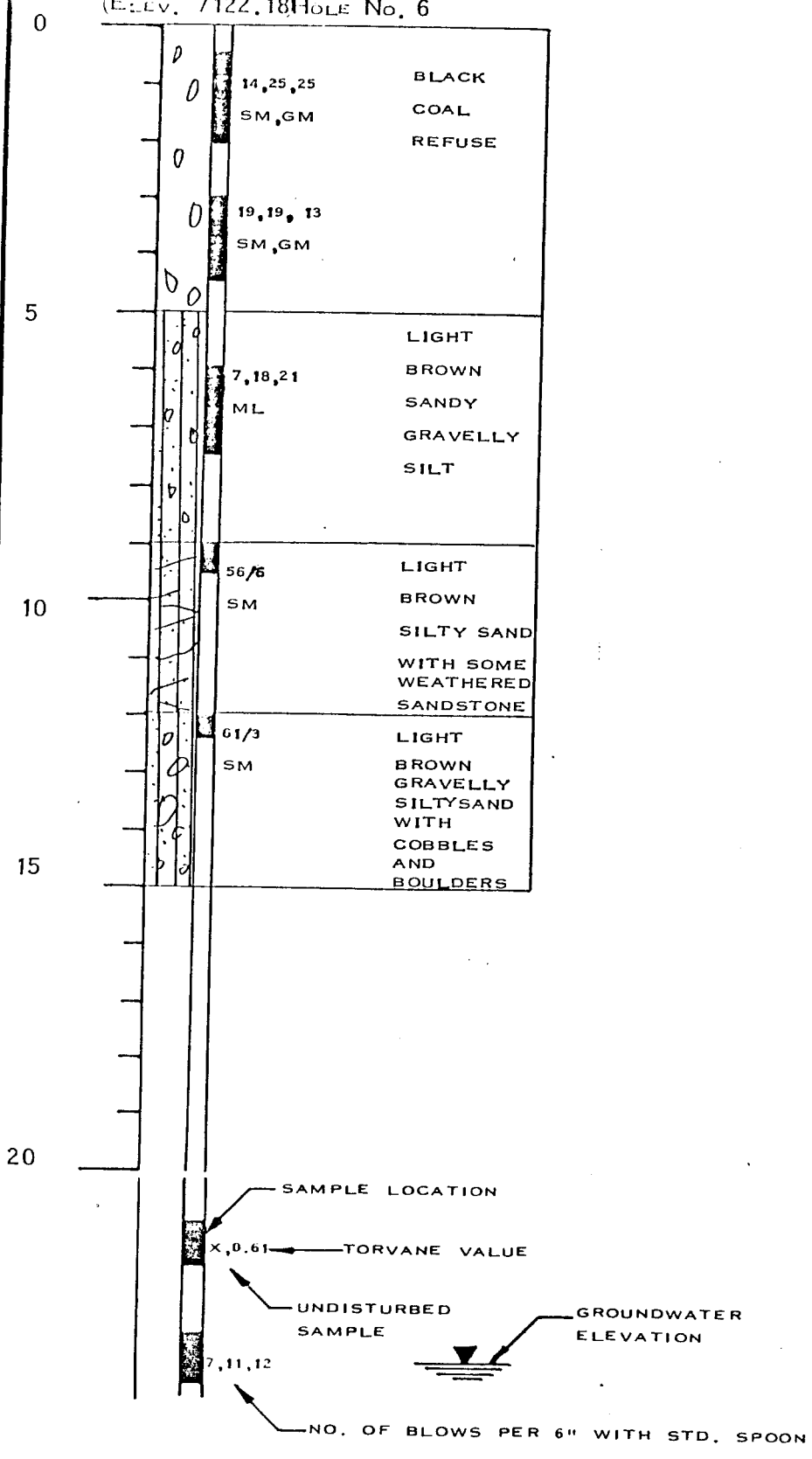
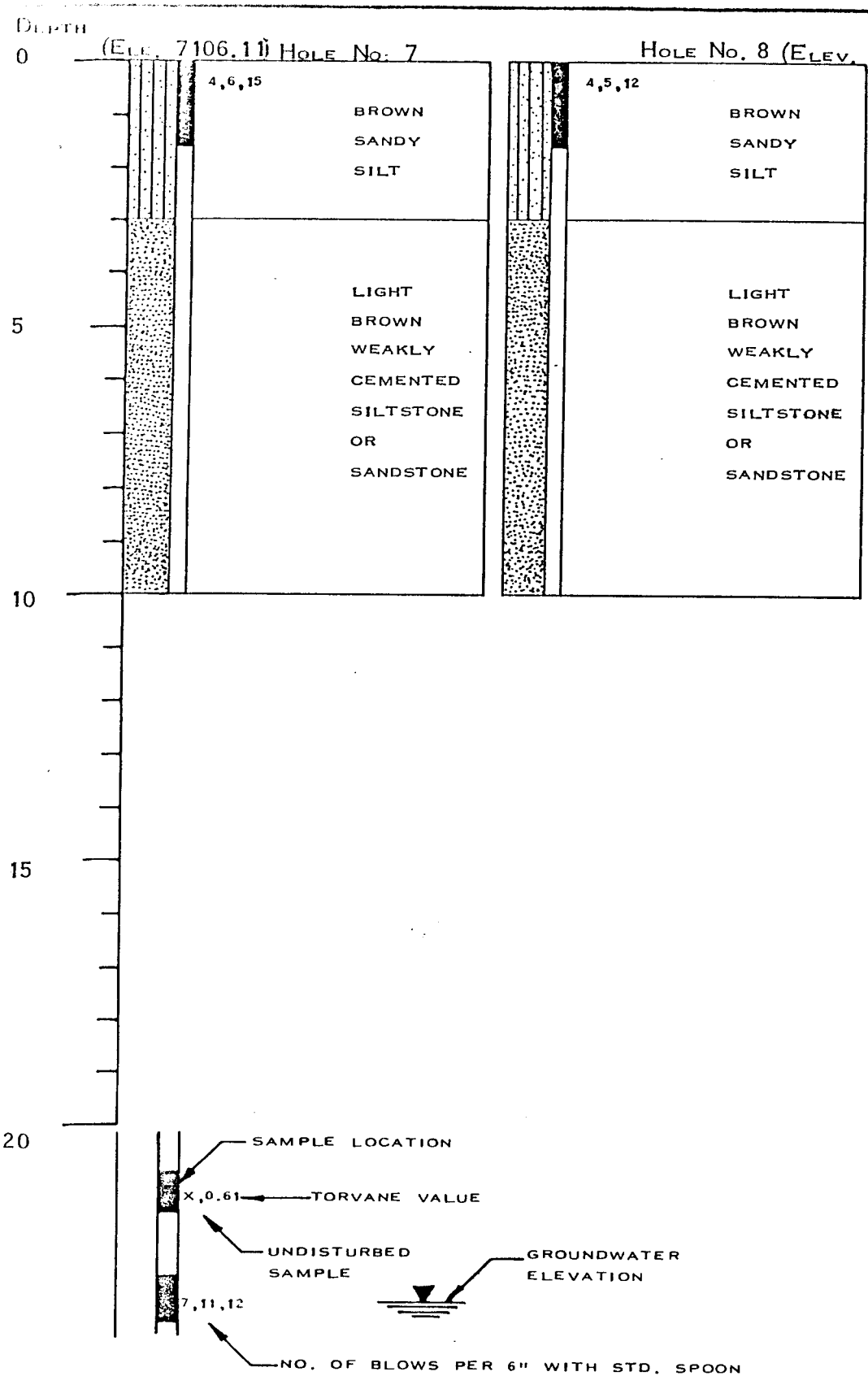
LOG OF BORINGS FOR: U.S. FUEL	ROLLINS, BROWN AND GUNNELL, INC. CONSULTING ENGINEERS	FIGURE NO. 4.



LEGEND

LOG OF BORINGS FOR: U.S. FUEL	ROLLINS, BROWN AND GUNNELL, INC. CONSULTING ENGINEERS	FIGURE No. 5



LEGEND

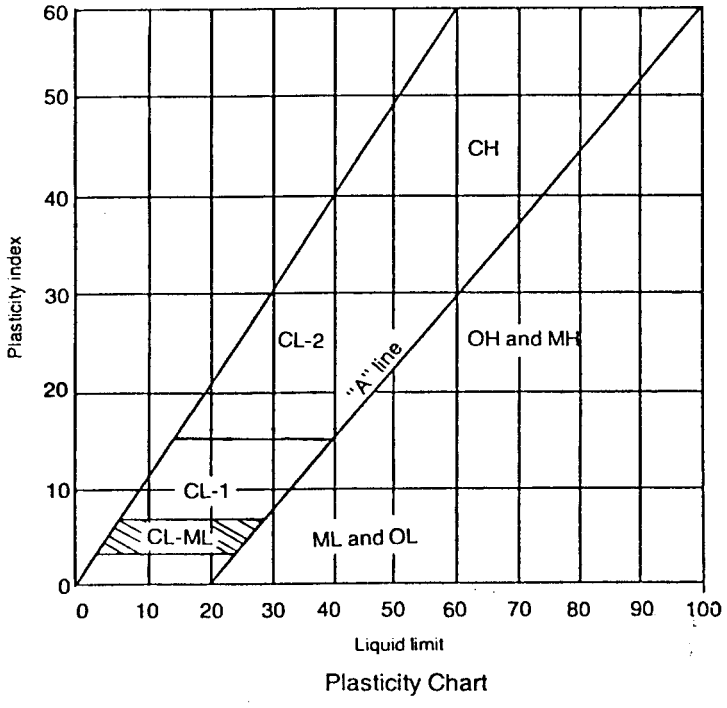
LOG OF BORINGS FOR: U.S. FUEL	ROLLINS, BROWN AND GUNNELL, INC. CONSULTING ENGINEERS	FIGURE NO. 6

FIGURE NO. 7

Unified Soil Classification System

Major divisions		Group symbols	Typical names	Laboratory classification criteria
Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$Cu = \frac{D_{60}}{D_{10}}$ greater than 4, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
	Gravels with fines (Appreciable amount of fines)	GM* (d / u)	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
		GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$Cu = \frac{D_{60}}{D_{10}}$ greater than 6, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
		SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
	Sands with fines (Appreciable amount of fines)	SM* (d / u)	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual sysbols.
		SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. less than 7
Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
		CL (1 / 2)	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL	Organic silts and organic silty clays of low plasticity	
Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		CH	Inorganic clays of high plasticity, fat clays	
		OH	Organic clays of medium to high plasticity, organic silts	
Highly organic soils		Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols**



Plasticity Chart

Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits,
u used when L. L. is 28 or less and the P.I. is 6 or less, the suffix u used when L. L. is greater than 28.
* Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols.
Example GW-GC, well-graded gravel-sand mixture with clay binder.

TABLE 1 SUMMARY OF TEST DATA

PROJECT U. S. FUEL FEATURE .. LOCATION

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRA. BLOWS PER FT.	IN-PLACE			UNCONFINED COMPRESSIVE STRENGTH LB/FT²	FRICTION ANGLE Φ	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			SOIL CLASSIFICATION UNIFIED SYSTEM
			UNIT WEIGHT LB/FT³	MOISTURE PERCENT	VOID RATIO			L.L. %	P.L. %	P.I. %	% GRAVEL	% SAND	% SILT & CLAY	
1	3- 4.5										10.4	72.9	16.7	SM,GM
	14-15.5										23.8	61.4	14.8	SM,GM
	24-25.5										44.7	49.7	5.6	GW,GM
	35-36.5										65.5	30.0	4.5	GW,GM
	45-46.5										37.9	34.1	28.0	GM
	50-51.5										91.3	6.8	1.9	GP
	55-56.5										53.2	35.1	11.7	GW,GM
	62-63.5										37.6	41.3	21.1	GM
2	5- 6.5										37.7	58.1	4.2	SW,GW
	15-16.5										53.2	44.1	2.7	GP
	25-26.5										58.3	36.6	5.1	GW,GM
	35-36.5										39.6	60.4	0.0	SW,GW

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

TABLE 1 SUMMARY OF TEST DATA (CONTINUED)

PROJECT U. S. FUEL FEATURE ·· LOCATION

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRA. BLOWS PER FT.	IN-PLACE			UNCONFINED COMPRESSIVE STRENGTH LB/FT^2	FRICTION ANGLE ϕ	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			SOIL CLASSIFICATION UNIFIED SYSTEM
			UNIT WEIGHT LB/FT^3	MOISTURE PERCENT	VOID RATIO			L.L. %	P.L. %	P.I. %	% GRAVEL	% SAND	% SILT & CLAY	
2	45-46.5										60.5	27.0	12.5	GM
	50-51.5										62.6	27.8	9.6	GW,GM
	55-56.5										61.4	31.5	7.1	GW,GM
	60-61.5										9.6	47.9	42.5	SM,GP

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ROLLINS, BROWN AND GUNNELL, INC.
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SOILS AND FOUNDATION INVESTIGATION

COAL HANDLING FACILITIES
U. S. FUEL
HIAWATHA, UTAH

MARCH 1979

SOILS AND FOUNDATION INVESTIGATION

COAL HANDLING FACILITIES
U. S. FUEL
HIAWATHA, UTAH

MARCH 1979

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS
1435 WEST 820 NORTH, P.O. BOX 711, PROVO, UTAH 84601

DRILLING PROGRAM

COORDINATES AND ELEVATION AT TOP OF HOLE

Hole 6-A - El. 7124.0'	Coordinates	(S 85' (E196'
Hole 7 - El. 7106.1'	Coordinates	(S 230' (E 476'
Hole 8 - El. 7102.5'	Coordinates	(S 455' (E 584'
Hole 9 - El. 7128.0'	Coordinates	(S 2937' (E 1393'

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

1435 W. 820 N.
P.O. Box 711
Provo, Utah
84601

MARCH 13, 1979

U. S. FUEL
UNIVERSITY CLUB BUILDING
136 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

ATTENTION: KENT WILTON

GENTLEMEN:

ON NOVEMBER 30, 1978, WE SUBMITTED TO YOUR ORGANIZATION A SOILS REPORT FOR THE PROPOSED HANDLING FACILITIES AT THE U. S. FUEL OPERATIONS IN HIAWATHA, UTAH. SITE INVESTIGATIONS DISCUSSED DURING THAT REPORT INCLUDED A RAW COAL STORAGE PILE, A WASHED COAL STORAGE PILE, A CONCRETE SILO AND A 48-INCH CONVEYOR AND PRELOAD SCALE.

IN ADDITION TO THE ABOVE FACILITIES, SOME SHALLOW BORINGS WERE PERFORMED AT AN ALTERNATE SITE FOR THE RAW COAL STORAGE AND WASHED COAL STORAGE PILES. IN OUR PRELIMINARY REPORT, RECOMMENDATIONS WERE MADE TO EXTEND THE BORINGS TO GREATER DEPTHS AT BOTH THE SILO SITE AND THE ALTERNATE SITE FOR THE CLEAN COAL PILE AND THE RAW COAL PILE. THIS REPORT OUTLINES THE RESULTS OF THE ADDITIONAL INVESTIGATIONS PERFORMED FOR THE SILO AND FOR THE ALTERNATE SITE ALONG WITH THE RESULTS OF BORINGS PERFORMED AT THE PROPOSED OVERPASS STRUCTURE.

THE RESULTS OF THE INVESTIGATION ARE OUTLINED BELOW.

1. SUBSURFACE SOIL AND WATER CONDITIONS

ONE BORING WAS DRILLED AT THE SILO LOCATION TO A DEPTH OF APPROXIMATELY 50 FEET, TWO BORINGS WERE DRILLED TO DEPTHS OF BETWEEN 53 AND 58 FEET AT THE PROPOSED ALTERNATE SITE FOR THE CLEAN AND RAW COAL STORAGE AND ONE BORING WAS DRILLED TO A DEPTH OF APPROXIMATELY 35 FEET AT THE PROPOSED SITE OF THE OVERPASS STRUCTURE.

DURING THE SUBSURFACE INVESTIGATION AT THIS SITE, SAMPLING WAS GENERALLY PERFORMED AT 3 TO 5-FOOT INTERVALS THROUGHOUT THE DEPTH INVESTIGATED. SAMPLES WERE OBTAINED BY DRIVING A 2-INCH SPLIT-SPOON SAMPLING TUBE THROUGH A DISTANCE OF 18 INCHES, WHERE POSSIBLE, USING A 140-POUND WEIGHT DROPPED FROM A DISTANCE OF 30 INCHES. THE NUMBER OF BLOWS TO DRIVE THE SAMPLING SPOON THROUGH

each 6 inches of penetration is presented on the boring logs where it was possible to drive the spoon through that depth. At many locations in each of the test borings performed throughout the area, it was not possible to drive the split-spoon sampling tube more than a few inches. In those cases, the number of inches driven and the number of blows to drive the spoon through that distance is presented at each sampling location. The boring log for Hole No. 6-A is presented in Figure No. 1. It will be observed that the subsurface material throughout the soil profile consists predominantly of granular-type soils except near the ground surface where a 5-foot layer of black coal refuse and a 4-foot layer of gravelly silt exists.

The results of the penetration tests indicate that the granular material below the refuse and the silt is in a medium dense condition and is capable of supporting moderate load intensities.

The boring logs for Test Holes No. 7 and No. 8, which define the characteristics of the subsurface material at the alternate raw and clean coal storage areas consist of granular material throughout the entire depth investigated. In the upper portion of the soil profile, the subsurface material consists of silty sandy gravel with some cobbles. However, the amount of cobbles and boulders increases considerably with depth. In the lower portion of the soil profile it was virtually impossible to obtain a sample because of the large amount of cobbles and boulders in this area.

The results of the subsurface exploration for these two borings indicates that the material at this location is capable of supporting moderately high load intensities. The boring log for Test Hole No. 9, which defines the characteristics in the vicinity of the overpass structure, is presented in Figure No. 2, and it will be noted that the subsurface material in the upper 17 feet of the soil profile is predominantly granular-type soils. Some clay is intermixed with the sand and gravel, however. A brown silty clay zone exists from about 17 feet to 28 feet below the ground surface afterwhich the remainder of the profile consists predominantly of granular material.

The results of the penetration tests indicate that the granular soils in the upper portion of the profile of Test Hole No. 9 are in a medium dense state.

No groundwater was encountered in this test boring, and it is not anticipated that any groundwater will exist within the zone of significant stress for any of the borings drilled throughout this general area.

2. Foundation Considerations

A. Concrete Storage Silos

In our original report, we assumed that the concrete storage silos would be 75 feet in diameter and 200 feet high with a total capacity of 12,000 tons. It was assumed in our report that a mat foundation would be used to support the proposed facility at this location. We indicated in our original report that the refuse material and the silts in the upper 9 feet of the soil profile were not capable of supporting the proposed facility using a mat foundation and we recommended that the bottom of the mat foundation extend to the granular material in the vicinity of 10 feet below the existing ground surface. An alternate to extending the mat to this depth consisted of excavating the silt and the refuse material and replacing it with compacted granular material.

The results of the additional boring performed at this site indicates that the granular material extends to a substantial depth below the existing ground surface.

Since the allowable soil bearing pressure, with respect to shear failure, for foundations on granular material is a function of the width of the footing, no problem exists at this location with respect to bearing capacity associated with shear failure. Settlement criteria, therefore, will govern the allowable soil bearing pressure used to support the proposed facility. If the total settlement of the proposed structure is restricted to approximately one inch, the maximum allowable soil bearing pressure which should be placed on the facility should not exceed about 2.5 tons per square foot. This would require a mat foundation between 85 and 90 feet in diameter depending upon the actual structural loads.

B. Washed Coal Storage Pile

In our previous report, we assumed that the washed coal storage pile would be 230 feet in diameter and 81 feet high and that the total load would be approximately 25,000 tons. It was also assumed that a concrete box 14 feet square and 14 feet high would be located at the bottom of the clean coal pile and that the circular stack approximately 14 feet in diameter would rise from the box and extend to the top of the coal pile. We also assumed that a tunnel would pass through the coal pile and that the tunnel may be as large as 18 feet in diameter. Because of the considerable depth of refuse material which existed at that site, it was concluded that piles would be required to support the tunnel and the structure located in the center of the pile.

The logs for Borings No. 7 and No. 8 at the alternate site indicate that the subsurface material to a depth of at least 55 to 60 feet is medium to dense granular material and is capable of supporting relatively high load intensities. It is our opinion that this material is entirely capable of supporting the proposed facility using spread foundations on the natural material.

The results of this investigation indicate that if the foundations for the proposed clean coal storage pile are located at a depth of about 15 feet below ground surface an allowable soil bearing pressure of approximately 3 tons per square foot can be safely used to proportion foundations for these facilities.

C. Raw Coal Storage Pile

Since the concrete facilities beneath the coal pile for this facility are essentially the same as those for the washed coal pile, foundation recommendations for this facility are essentially the same as those discussed in the previous section of this report. We recommend that an allowable soil bearing pressure of 3 tons per square foot be used to proportion foundations for this facility.

D. Overpass Structure

As of the preparation of this report, the exact configuration of the overpass structure is not known. If the overpass facility is accomplished by excavating into the natural material, the abutment foundations for the proposed structure would likely rest on natural material. If the overpass structure is accommodated by providing approach fills, the abutment structures would be located on fill material. For the purpose of this report, it has been assumed that all foundations contemplated for the proposed structure would be located on natural material and that the foundations would be located such that the zone of significant stress would exist within the granular material defined by Test Hole No. 9.

In order to proportion the foundations located on level ground, a bearing capacity chart as shown in Figure No. 3 has been provided. In providing this bearing capacity chart, consideration has been given to both differential settlement and shear failure. The lines sloping upward to the right define the allowable soil bearing pressure with respect to shear failure, while the curve sloping downward to the right defines the allowable soil bearing pressures such that the maximum settlement of any footing will not exceed one inch.

If foundations are proportioned in accordance with Figure No. 3, differential settlement throughout the structure will not likely exceed one-half

inch, which will likely be tolerable for the spans contemplated for the proposed facility.

If the foundations for the proposed structure are located at the top of the cut slopes for the overpass, we recommend that the allowable soil bearing pressures be determined in accordance with Table No. 1. It will be noted that this table is based upon a fixed depth of the bottom of the footing below the adjacent ground surface as well as a fixed distance from the crest of the slope to the edge of the footing.

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which, in our opinion, define the characteristics of the subsurface material in a satisfactory manner.

If there are any questions relative to the information contained herein, please advise us.

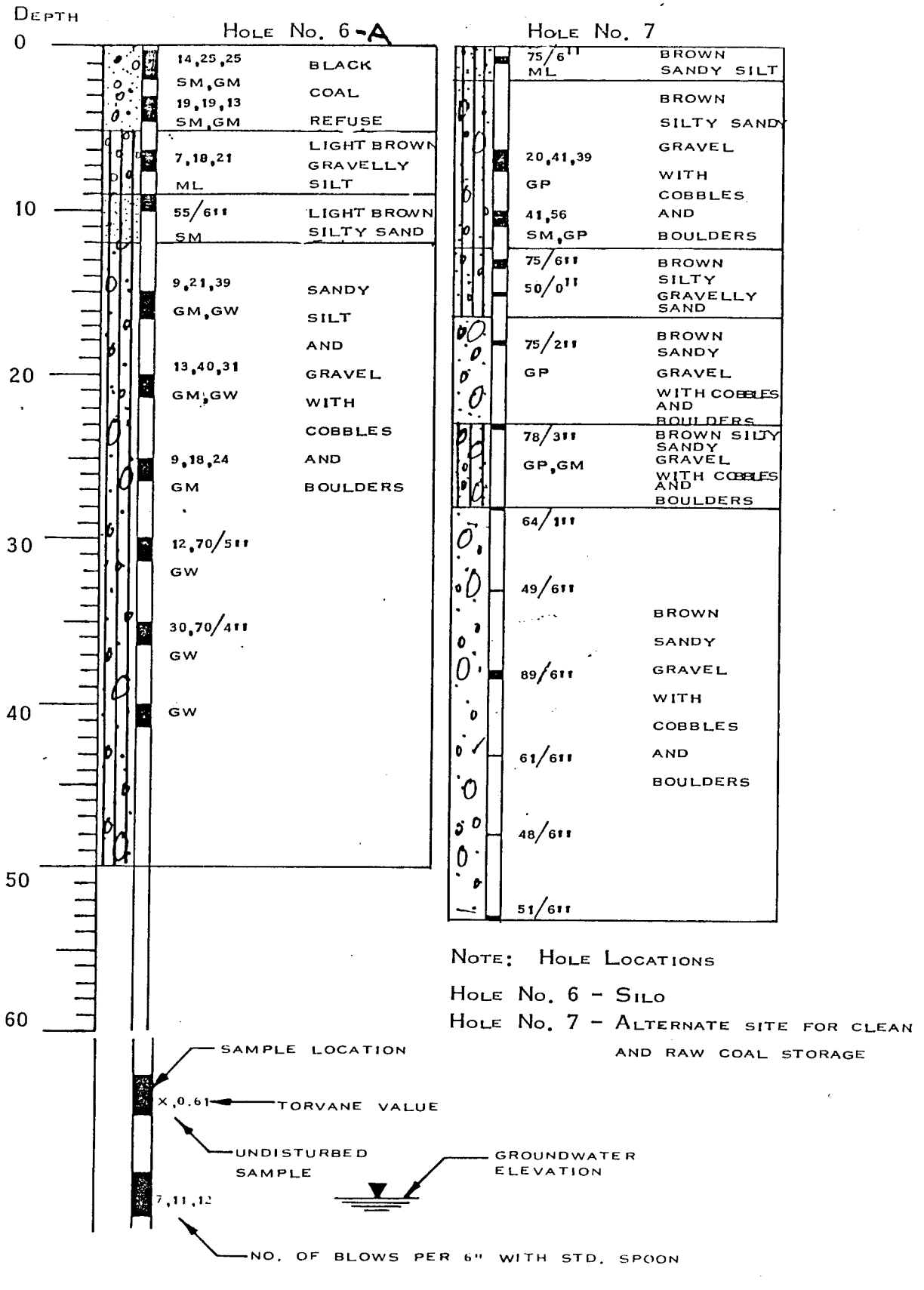
Yours truly,

ROLLINS, BROWN AND GUNNELL, INC.

Ralph L. Rollins

Ralph L. Rollins

DMK
Enclosures



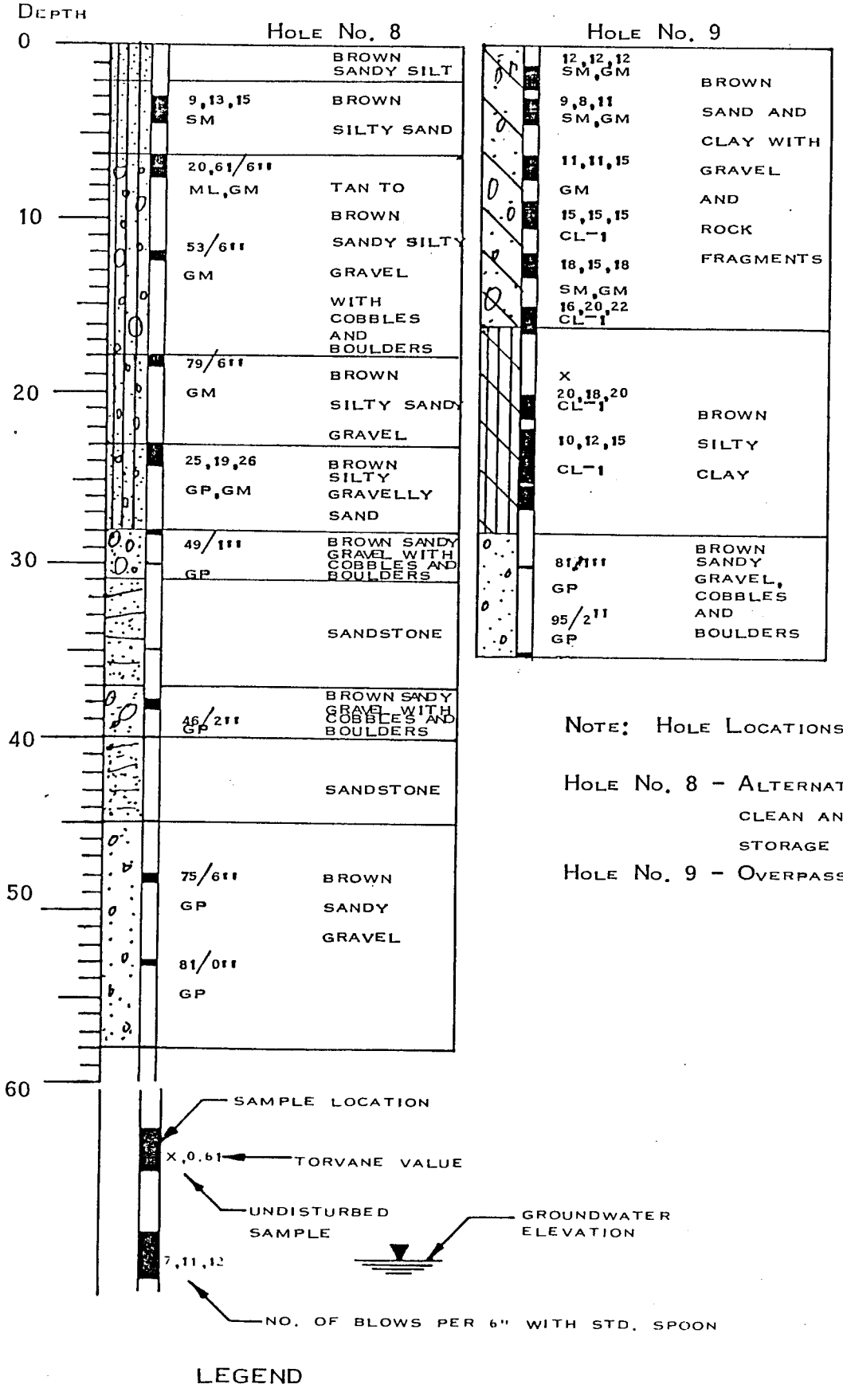
NOTE: HOLE LOCATIONS

HOLE No. 6 - SILO

HOLE No. 7 - ALTERNATE SITE FOR CLEAN AND RAW COAL STORAGE

LEGEND

LOG OF BORINGS FOR: U. S. FUEL	ROLLINS, BROWN AND GUNNELL, INC. CONSULTING ENGINEERS	FIGURE No. 1



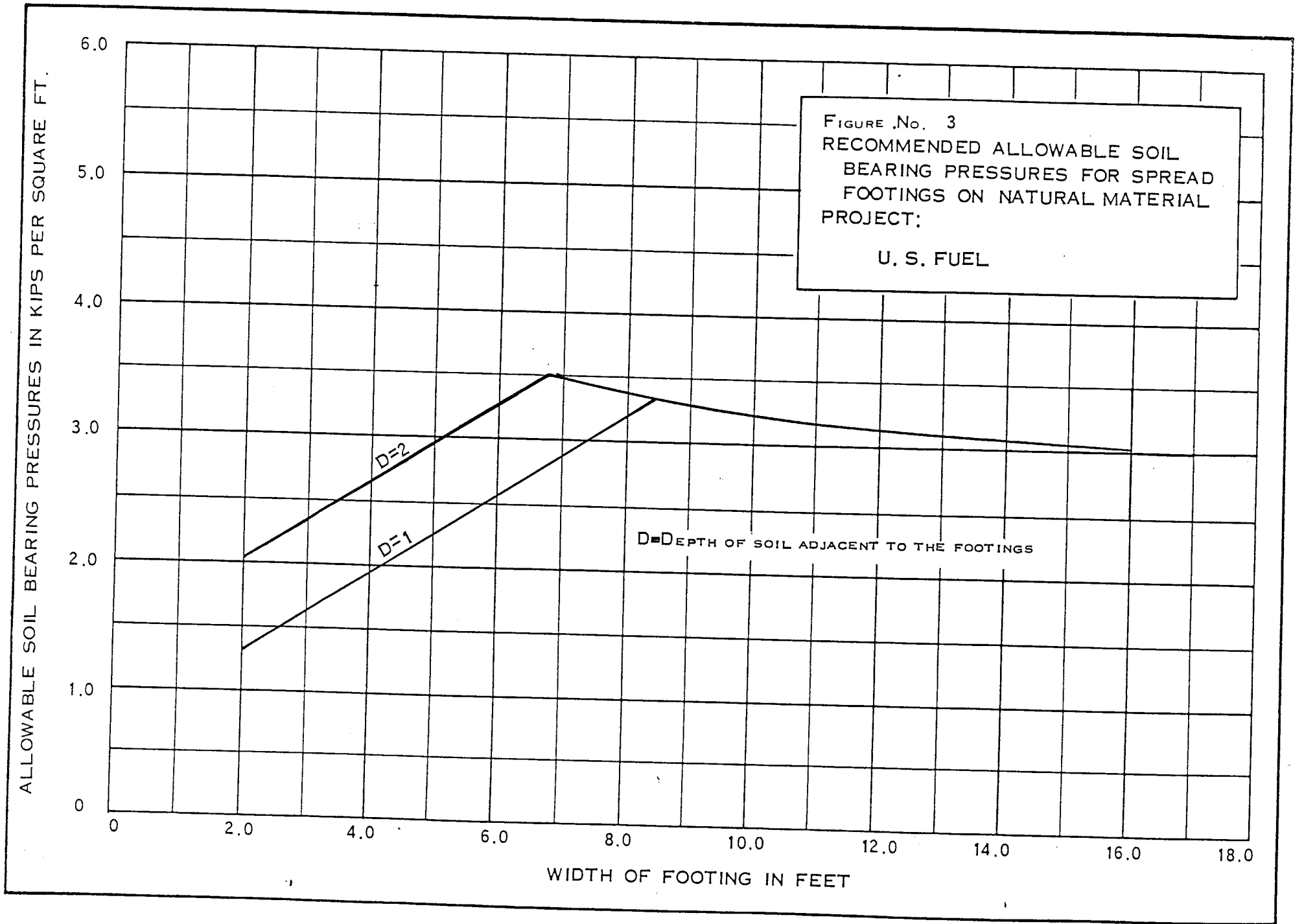
LEGEND

NOTE: HOLE LOCATIONS

HOLE No. 8 – ALTERNATE SITE FOR CLEAN AND RAW COAL STORAGE

HOLE No. 9 – OVERPASS STRUCTURE

LOG OF BORINGS FOR: U. S. FUEL	ROLLINS, BROWN AND GUNNELL, INC. CONSULTING ENGINEERS	FIGURE No. 2



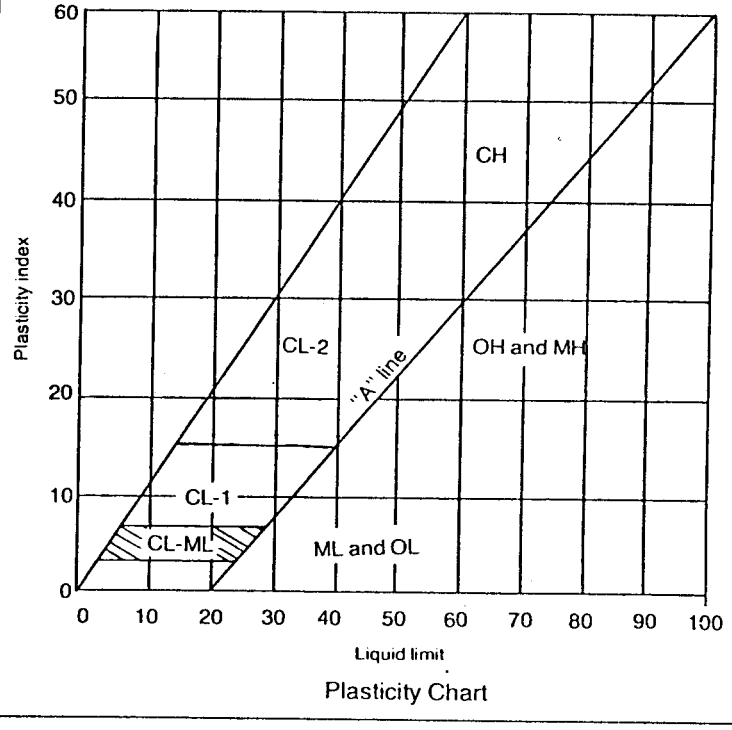
ROLLINS, BROWN AND GUNNELL, INC.

FIGURE NO. 4

Unified Soil Classification System

Major divisions			Group symbols	Typical names	Laboratory classification criteria
(More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$Cu = \frac{D_{60}}{D_{10}}$ greater than 4, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM* d/u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$Cu = \frac{D_{60}}{D_{10}}$ greater than 6, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM* d/u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual sysbols.
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. less than 7
(More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL 1/2	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils		Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols**



Plasticity Chart

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits, d used when L. L. is 28 or less and the P.I. is 6 or less, the suffix u used when L. L. is greater than 28.
**Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. Example: GW-GC, well-graded gravel-sand mixture with clay binder.

TABLE NO. 1

Allowable Soil Bearing Pressures For Foundations Located Near the Cut Slope Of the Overpass

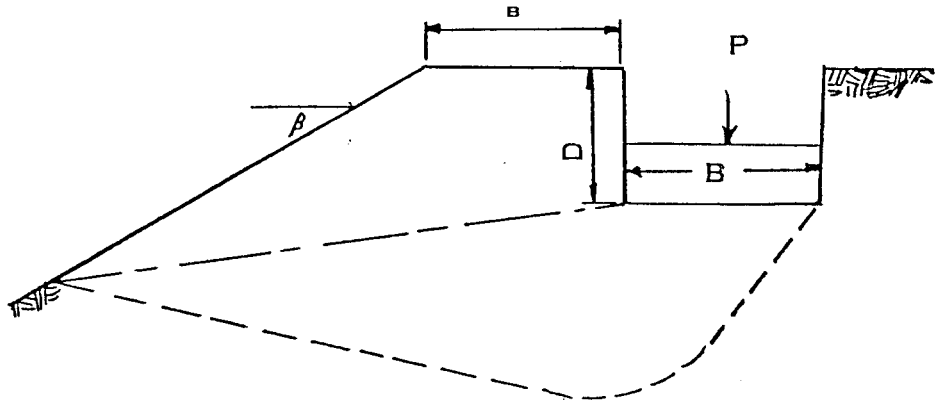
Width of Footing (feet)	Allowable Soil Bearing Pressure (lbs./ft.^{2})
2	1.80
4	2.43
6	2.97
8	3.08

Note: Minimum recommended values used in the table:

B = 3 feet

D = 3 feet

$\beta = 30^0$



ROLLINS, BROWN & GUNNELL, INC. **CONSULTING ENGINEERS**	Allowable Soil Bearing Pressures For Foundations Located Near the Cut Slope of the Overpass U. S. Fuel, Hiawatha, Utah	Table No. 1

BRUNING 40-105 37146

TABLE 2 SUMMARY OF TEST DATA

PROJECT U. S. FUEL FEATURE FOUNDATIONS LOCATION HIAWATHA, UTAH

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRA. BLOWS PER FT.	IN-PLACE			UNCONFINED COMPRESSIVE STRENGTH LB/FT²	FRICTION ANGLE ϕ	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			SOIL CLASSIFICATION UNIFIED SYSTEM
			UNIT WEIGHT LB/FT³	MOISTURE PERCENT	VOID RATIO			L.L. %	P.L. %	P.I. %	% GRAVEL	% SAND	% SILT & CLAY	
6	15-16.5	60									62.5	27.1	10.4	GM,GW
	20-21.5	71									45.9	43.1	11.0	GM,GW
	25-26.5	42									53.1	29.1	17.8	GM
	30-31.5	70									79.2	17.7	3.1	GW
	35-36.5	70									52.0	44.6	3.4	GW
	40-41.5	70									87.3	8.6	4.1	GW
9	1- 2.5	24									31.0	40.8	28.2	SM,GM
	3- 4.5	19									24.0	49.5	26.5	SM,GM
	6- 7.5	26									44.9	34.3	20.8	GM
	9-10.5	30						23.0	16.0	7.0				CL-1
	12-13.5	33									29.9	36.7	33.4	SM,GM

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

TABLE 2 SUMMARY OF TEST DATA

PROJECT U. S. FUEL FEATURE FOUNDATIONS LOCATION HIAWATHA, UTAH

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRA. BLOWS PER FT.	IN-PLACE			UNCONFINED COMPRESSIVE STRENGTH LB/FT²	FRICTION ANGLE ϕ	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			SOIL CLASSIFICATION UNIFIED SYSTEM
			UNIT WEIGHT LB/FT³	MOISTURE PERCENT	VOID RATIO			L.L. %	P.L. %	P.I. %	% GRAVEL	% SAND	% SILT & CLAY	
9	15-16.5	42						25.6	14.6	11.0				CL-1
	20-21.5	38						23.9	15.0	8.9				CL-1
	25-26.5	27						24.3	15.1	9.2				CL-1

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

Railroad Underpass Soil Conditions

Construction of the underpass will permanently disturb .73 acres. Evaluation of the soil resources, in this area, indicate that only the upper 12 inches is suitable for reclamation. Therefore, only this material will be salvaged and protected for use in final reclamation. The 1,177 cubic yards of materials salvaged will be moved to the topsoil stockpile which is immediately east of Slurry Pond #5. This topsoil, located within the bounds of the defined disturbed area (see Exhibit VIII-4A), is protected from erosion by both a primary runoff control diversion which is constructed around the topsoil pile and a diversion ditch furthur to the west which will intercept all flow from upstream runoff. The topsoil pile has also been revegetated in order to control erosion by means of plant growth stabilization. Currently the dimensions of the stockpile are 48 by 68 by 8.5 feet high and contains 1,028 cubic yards of topsoil.

The topsoil, which has been and will be stockpiled, at this location is protected for long term storage by the following methods: the topsoil is stripped from it's insitu location and moved to the storage area. The previous surface of the storage area was prepared prior to salvage by removing existing vegetation and by scarifying the surface. The new material is then placed with suffiecient compaction to encure long toerm stability, but without creating a deliterious condition which prevents plant root growth. The side slopes will slope gradually at an angle of 3 : 1 to where it intersects the runoff diversion circumscribed around the pile. The area will be seeded with mix No. 1, which will be broadcast at the prescribed rate.

The stockpiled topsoil, salvaged before the construction of the underpass will be used in the final reclamation of the refuse piles as the unerpass will be a permanent structure as a part of the state highway and will not be reclaimed.

The results of the field investigation and subsequent laboratory analyses (see Table VIII-18) of the extremely cobbley (35 to 45 percent cobbles) nature of the subsoil, indicate that only the upper 12 inches is suitable for use in reclamation.

The soil at the underpass, a gravelly sandy loam, has a fair available waterholding capacity at 7.5 percent. The percentage of rock fragments varies from 9.7 to 33.0 percent averaging 16.4 percent which has fair suitability for reclamation. Additionally a 40 percent saturation percentage has good suitability. Therefore the overall physical characteristics of this soil will not be a significant limiting factor for use in reclamation.

The chemical characteristics also indicate that use of this soil for reclamation will be beneficial to post mining reclamation. The pH of 8.3, a 0.3 ECe, and a 0.6 SAR support this conclusion. It will be necessary to add some soil nutrients and amendments to enhance vegetative regrowth. The 1.8 average percentage of organic matter coupled with the 2.9 percent average nitrate nitrogen content indicate that forty pounds per acre of nitrogen are needed to enhance vegetative regrowth. To achieve the desired application rate, approximately one hundred pounds per acre of sulfur coated urea (45-0-0) would need to be added. The average phosphorus level, 2.1 ppm, is low and requires the addition of 30 pounds per acre of P_2O_5. This can be added in the form of a treble super phosphate.

TABL III-21

SOIL LABORATORY ANALYSES

DISTURBED SOILS AT PREPARATION PLANT

Sample	Area	pH	ECe[a]	SAR[b]	OM[c]	NO_3-N[d]	P[e]	K[e]	NA[e]	CA[e]	Mg[e]	Sp[f]	Texture[g]	AWC %	>2MM
1	PP	8.4	0.3	0.4	1.9	3.9	1.3	20	0.6	3.1	0.5	34	SL	7.5	24.0
2	PP	8.1	0.4	0.6	4.1	2.8	4.9	110	0.8	3.0	0.7	36	SL	10.4	3.2
3	PP	8.0	1.1	0.5	2.7	7.0	6.0	129	1.2	7.4	2.3	39	SL	7.4	31.4
4	PP	8.1	1.0	1.4	4.4	4.3	11.0	126	2.8	5.9	1.6	33	SL	8.7	18.5
5	USY	8.0	0.6	0.8	0.9	1.5	1.3	45	1.2	4.1	0.8	27	SL	5.8	47.2
6	USY	8.0	0.6	0.4	0.6	0.5	11.0	112	0.6	4.3	1.1	26	SL	10.8	<.1
7	USY	8.1	0.4	0.5	2.9	3.1	1.5	79	0.7	3.6	0.8	42	L	13.3	18.0
8	USY	8.0	0.6	0.9	1.2	4.3	6.5	>400	1.6	5.5	1.5	31	SL	7.6	29.1
9	UP	8.1	0.2	0.4	1.4	2.2	1.4	65	0.5	2.2	0.3	40	L	10.0	9.7
10	UP	8.3	0.3	0.6	2.0	7.0	2.8	58	0.5	1.1	0.5	40	SL	7.3	33.0

[a] ECe - Electrical Conductivity of Saturation Extraction in mmhos/cm

[b] SAR - Sodium Adsorption Ratio

[c] OM - Organic Matter in Percent

[d] NO_3-N - Nitrate Nitrogen

[e] - Soluble in Saturation Extract in ppM

[f] Sp - Saturation Percentage

[g] Texture - L = Loam SL = Sandy Loam

[h] AWC - Available Water Capacity in Percent

Appendix III-10

APPENDIX III-10

South Fork Conveyor Deer Crossing

STATE OF UTAH
NATURAL RESOURCES & ENERGY
Wildlife Resources

596 West North Temple • Salt Lake City, UT 84116 • 801-533-9333

Scott M. Matheson, Governor
Temple A. Reynolds, Executive Director
Douglas F. Day, Division Director

FILE ACT/007/011
Folders # 3 # 7

April 19, 1983

Mr. Jim Shirazi, Director
Utah Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, UT 84114

Attention: Mary Boucek and Sandy Pruitt

Dear Jim:

The Division on April 8, 1983, inspected the modification to the U.S. Fuel Company's King 6 conveyor. The modifications made by the company relative to passage of deer are appropriate and considered to be complete. The conveyor now does not represent a barrier to deer movement.

Thank you for the cooperation and assistance provided by your staff.

Sincerely,

Douglas F. Day
Director

Appendix III - 11

APPENDIX III-11

Non-coal Waste Disposal Sites

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

August 13, 1981

Utah Department of Natural Resources
Division of Oil, Gas and Mining
1588 West North Temple
Salt Lake City, Utah 84116

Re: Plan for disposal of
non-coal wastes.

Dear Sirs:

The following plan is being submitted by U. S. Fuel for disposal of non-coal wastes.

NON-COAL WASTE DISPOSAL

The following designated sites shall be used for disposal of non-coal wastes:

DISPOSAL SITES

The first proposed waste disposal site is to be located on the west side of the Middle Fork yard. Drainage from that portion of the yard flows to the sediment pond below the coal loading facility. (See Map #1, sites denoted by blue shading on each map.)

The second site will be located near the upper coal storage facility, off from the Middle Fork canyon road. Any leachate or runoff from this area will be collected by a sediment pond below the tracks. (See Map #2)

The third site specified for non-coal wastes is located in the lower yard in the slurry impoundment area. All runoff from the lower yard areas is diverted to several sediment ponds. (See Map #3)

PLACEMENT

Placement and storage in these areas will take place in a controlled manner such that leachate and runoff does not degrade surface or ground water fires are prevented and the area remains stable and suitable for reclamation and revegetation.

TIME ALLOTMENT

Consolidation and storage of non-coal waste materials in these sites shall begin upon approval of the designated areas and be completed within a 6 month time frame.

Disposal of waste materials will be made on a regular basis and/or when necessary.

The three aforementioned areas shall constitute U. S. Fuel's non-coal waste disposal sites and be constructed and maintained according to UMC 817.89.

Yours very truly,

Jean Semborski

Jean Semborski,
Engineering Assistant

JS/ds

Enclosure(s)

cc: V. Posner

No new areas or wildlife will be disturbed through the use of the specified areas. No threatened or endangered species are known to exist in these areas.

5). The soil consists of rocky alluvium, coal fines and slurry in sites 1,2 and 3 respectively. As these areas were previously disturbed, no significant amount of topsoil was present on them. The area will be graded, scrified and topsoil distrubuted over the affected areas at the time of reclamation and after the materials stored there are removed. Topsoil redistribution will be in accordance with UMC 817.24 b. The area will be reseeded. The reclamation will follow the procedure as stated in the mine plan (Chapter III).

6). The areas have been previously disturbed, prior to the Surface Mining and Reclamation Act. A baseline study of the mine area can be found in the U.S. Fuel mine plan.

7). Final reclamation plans are to remove any remaining materials stored there and continue relamation as in the other areas of the mine. Final disposal of non-coal wastes stored at the sites will be disposed of in designated areas or if possible, covered by a minimum of two feet of soil. Slopes will be stabilized and revegetation accomplished in accordance with UMC 817.111-817.117. Areas will be graded and topsoil placed over the previously disturbed area. The area will be revegetated with the recommended species.

8). The ruin in the upper coal storage yard is part of an old foundation and has no particular importance. The entire mine area has been cleared with Utah's Department of State History (Chapter V and Appendix V-1 of the U.S. Fuel mine plan)

In addition to the three sites previously submitted, we would like to have two additional sites located in the South Fork (King 6) mine yard. Due to the size and physical separation (by canyons) of the U.S. Fuel mines,

more sites are needed to avoid transporting materials long distances. Location makes the site more useful and apt to be used and does not necessarily reflect a large quantity of this type of scrap material.

In conferance with Tom Portle on the subject of non-coal waste disposal sites, he agreed with our locations of sites, the need to have several, and felt they were located in adequately protected areas and didn't threaten the environment.

The fourth site would be located in the disturbed area of the South Fork mine yard to the east of the present maintenance shop. The area is protected by the sediment containment pond below the disturbed area. Drainage from this area is drawn on the enclosed map.

At present, there are materials stored here which were generated from an earlier mine in this area. Some materials have been displaced over the edge of the bench on which they and the maitenance shop are situated. A violation was issued on the material over the edge. Efforts have been made to pull this material back from the edge but were hampered by the presence of construction crews on the slope below. A berm exists alon the edge to prevent water from the bench causing erosion down the embankment.

We would like to propose retrieving the over bank material and storing it in the present storage area on the bench which is back against the canyon wall. Furthur clean up efforts will be delayed until approved non-coal wastes disposal sites are available for placement of these materials. This area is already disturbed, adequately protected and convienently located. The berm on the edge would be re-established to prevent erosion on the downslope. The mine yard sites would be reclaimed concurrent with reclamation of the mine yard.

The bench is composed primarily of rock. As this site was previously disturbed, no recoverable top soil is present.

No additional surface disturbance will be required for occupation of this site. The present sediment containment pond is adequately handling the run off and wont need to be increased due to the continued use of this site.

The type of waste to be stored in this area would include: old rail, wire, old mining equipment and timbers. No critical wildlife habitat or vegetation will be endangered through the use of this site.

The fifth site would be located on the bathhouse level, above the level of the fourth site. Materials such as those described for the other site have been stored here for many years. We would like to continue to store them at this site in the disturbed area.

The site is primarily underlain by rock, is quite stable, wouldn't endanger any wildlife or vegetation and is protected by the sediment containment pond. Drainage from this area passes through the mine yard to the sediment pond.

We hope your questions have been answered satisfactorially and the additional areas are discribed clearly.

Sincerely,

Jean Semborski

Ms. Jean Semborski
Engineering Assistant
U.S. Fuel Company

STATE OF UTAH
NATURAL RESOURCES & ENERGY
Oil, Gas & Mining

Scott M. Matheson, Governor
Temple A. Reynolds, Executive Director
Cleon B. Feight, Division Director

4241 State Office Building • Salt Lake City, UT 84114 • 801-533-5771

February 10, 1982

Ms. Jean Semborski
Engineering Assistant
U. S. Fuel Company
Hiawatha, Utah 84527

RE: Noncoal Waste Storage
Site Approval
Hiawatha Complex
ACT/007/011
Carbon County, Utah

Dear Ms. Semborski:

The Division has received U. S. Fuel Company's letter, received February 1, 1982, accepting the conditions of our stipulated approval for the five (5) temporary storage and disposal sites for noncoal wastes at the Hiawatha Mining Complex.

U. S. Fuel is hereby granted final approval to implement the use of these sites in accordance with the plans provided and the accepted conditions.

The Utah Department of State Health, Bureau of Solid Waste Management, has requested that in the future we direct the applicant to also contact their Division when permitting these types of issues to insure that all applicable state and/or federal laws and regulations which may be pertinent are properly addressed.

If there are any questions or comments pertinent to this approval, please contact us.

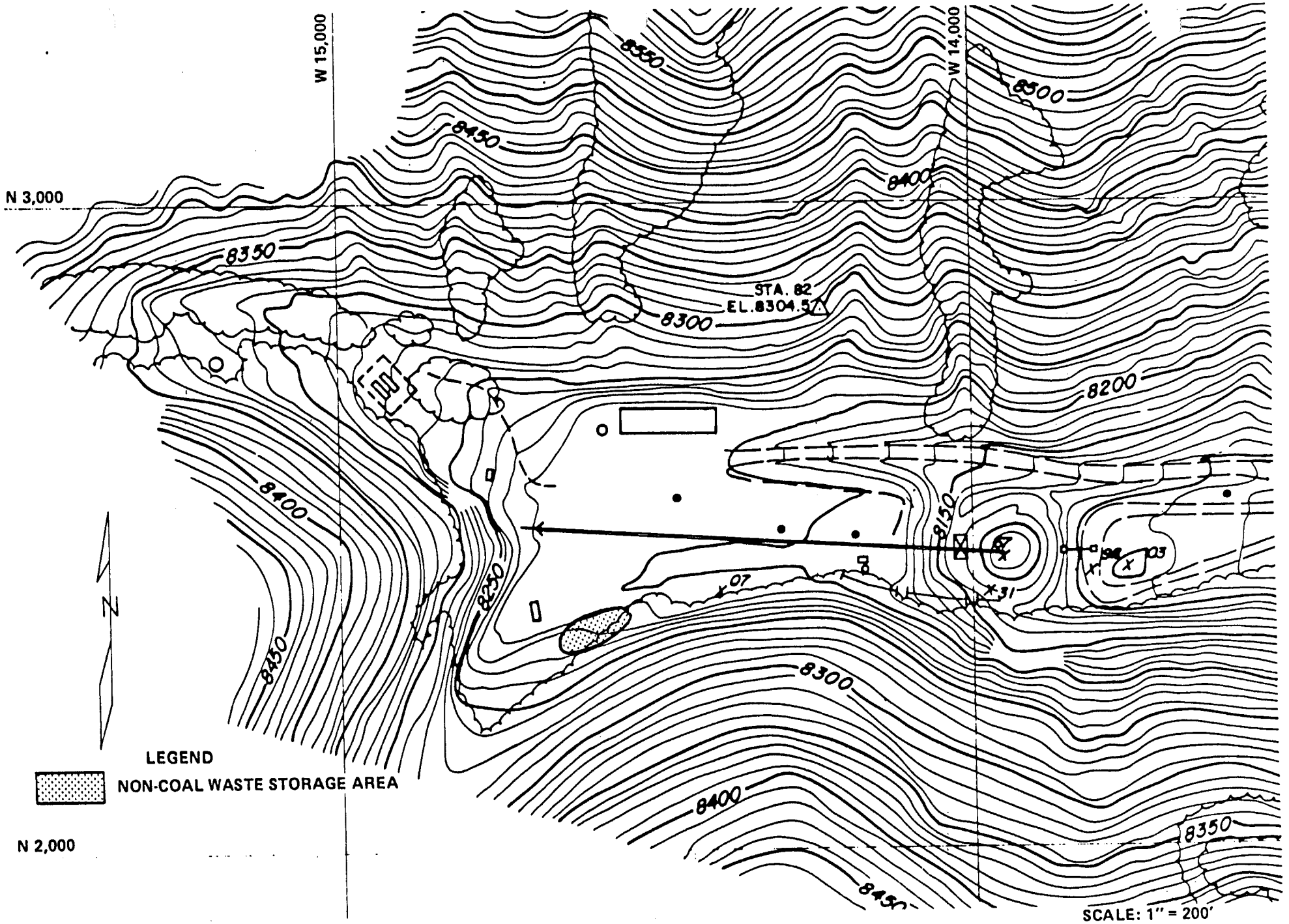
Sincerely,

D. Wayne Hedberg

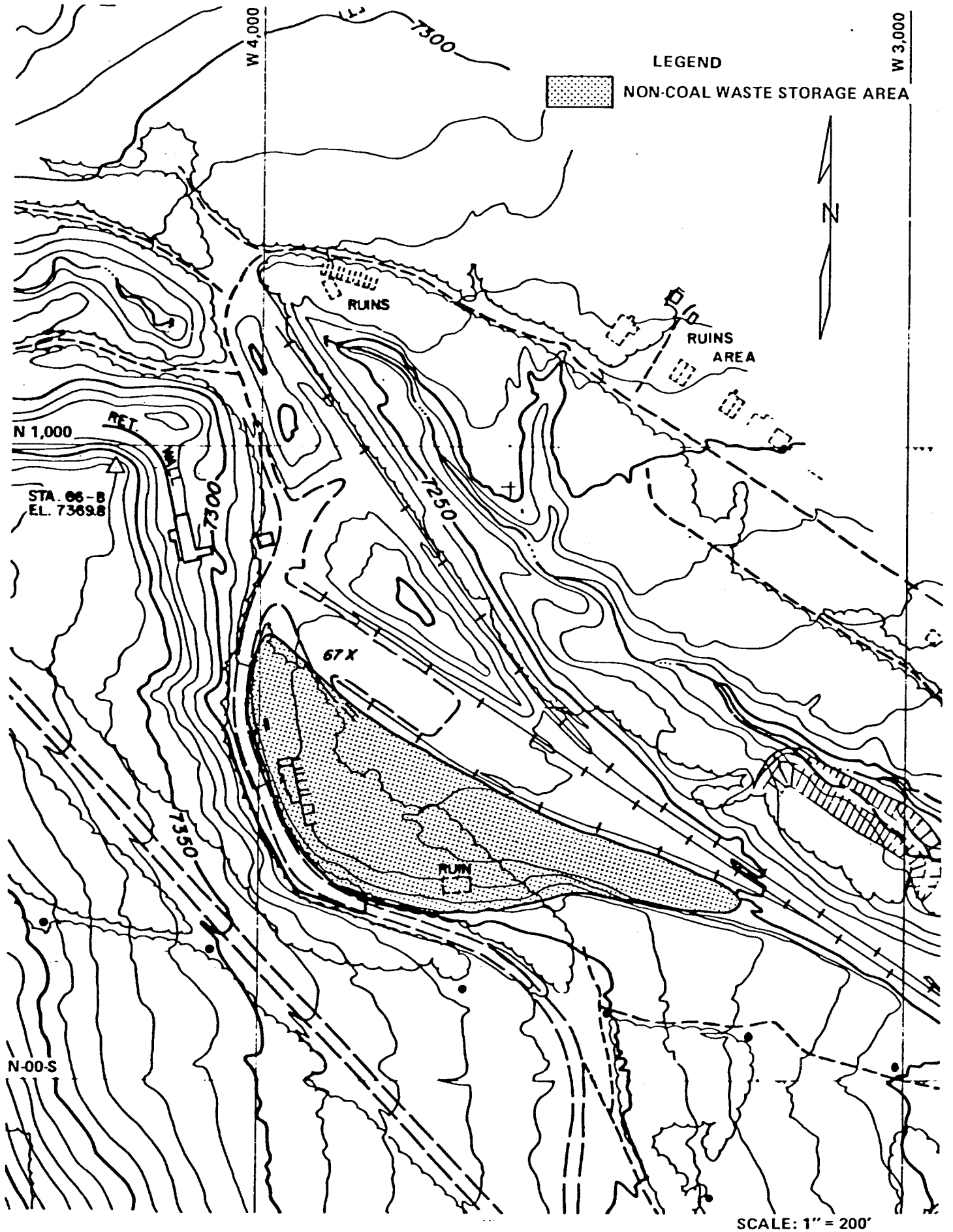
D. WAYNE HEDBERG
RECLAMATION HYDROLOGIST

cc: Jim Smith, DOGM
Richard Dawes, OSM
Kent Montaque, DSH
Joe Helfrich, I & E

DWH/btb



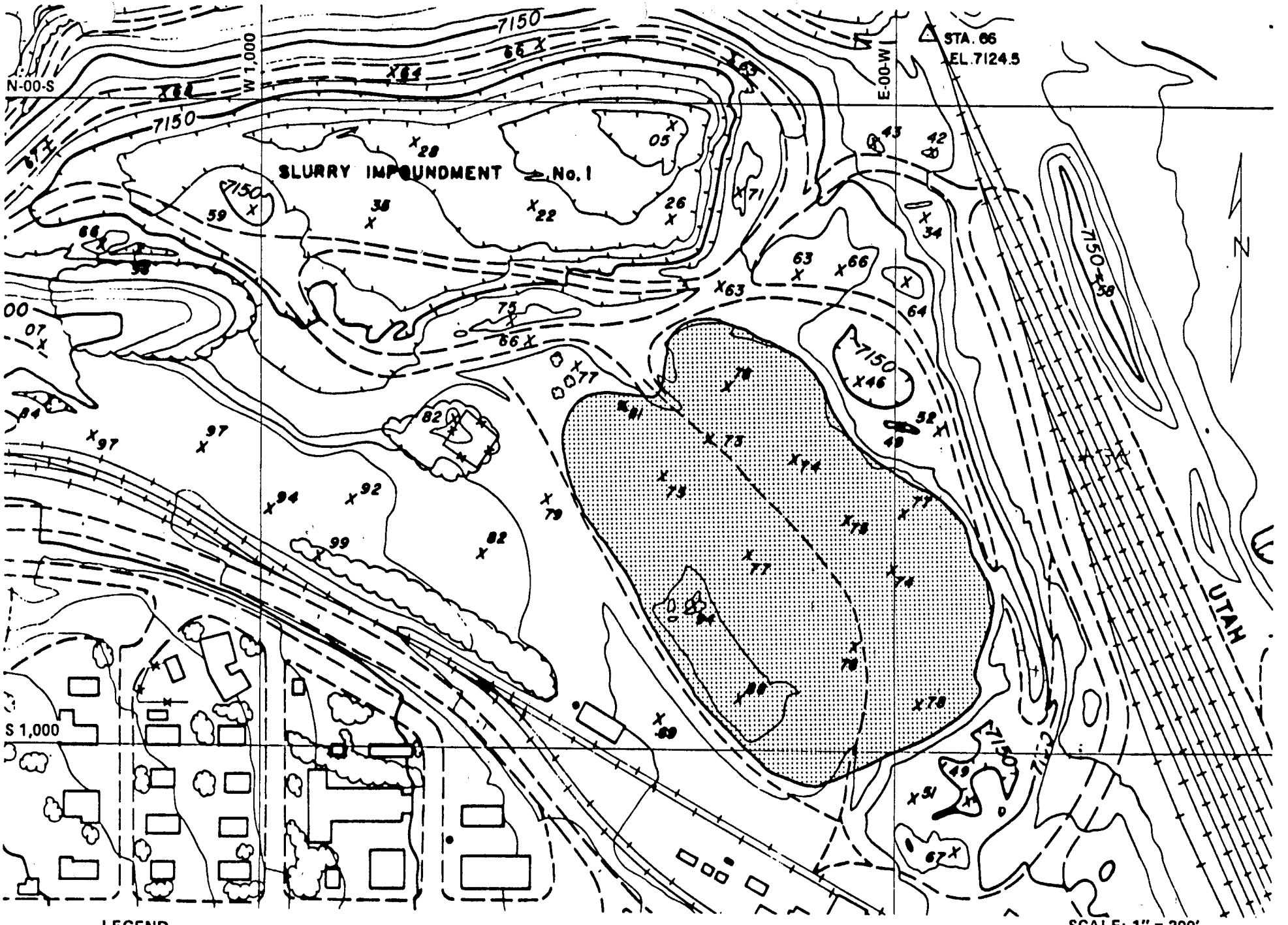
MAP NO. 1 - NON-COAL WASTE STORAGE
MIDDLE FORK YARD, SURFACE FACILITIES



SCALE: 1" = 200'

MAP NO. 2 - NON-COAL WASTE STORAGE

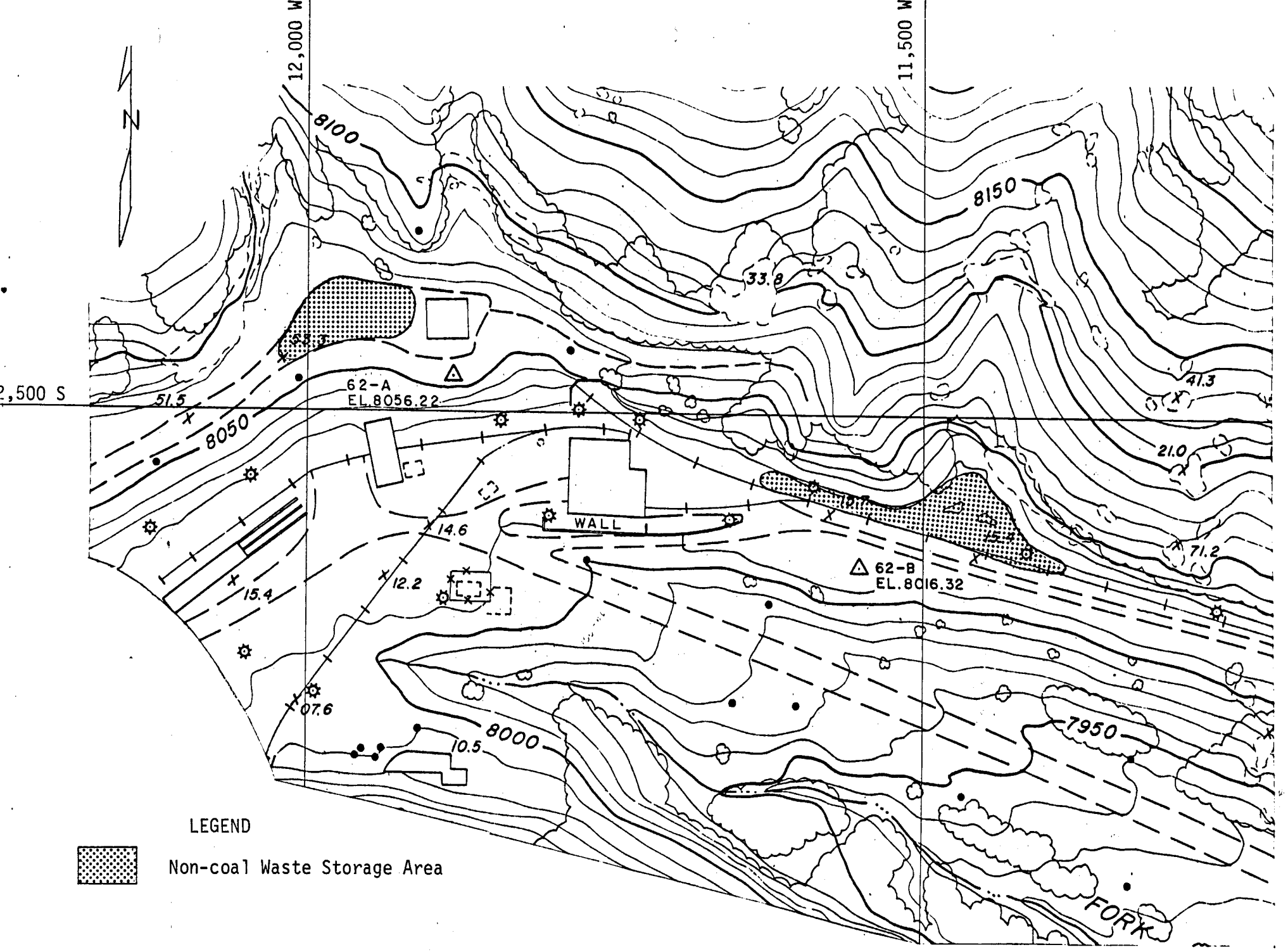
TITLE CONTOUR MAP, UPPER COAL STORAGE YARD



LEGEND

NON-COAL WASTE STORAGE AREA

MAP NO. 3 - NON-COAL WASTE STORAGE
LOWER YARD IN THE SLURRY IMPOUNDMENT AREA



LEGEND

Non-coal Waste Storage Area

MAP NO. 4 NON-COAL WASTE STORAGE SITE
SOUTH FORK MINE YARD, SURFACE FACILITIES

Scale 1" = 200'

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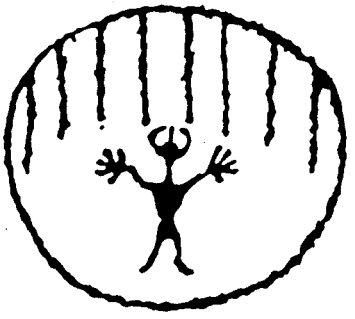
APPENDIX III-12

Cultural Survey - Middle Fork



BRIGHAM YOUNG UNIVERSITY
DEPARTMENT OF ANTHROPOLOGY
TECHNICAL SERIES NO. 83-60

A CULTURAL RESOURCE INVENTORY OF MILLER CREEK SURFACE FACILITIES IN CARBON COUNTY FOR U.S. FUELS

by
Dean Schleisman and Asa S. Nielson

Cultural Resource Management Services
A. S. Nielson, Principal Investigator
Department of Anthropology
Brigham Young University
Provo, Utah 84602

prepared for
Ford, Bacon and Davis, Inc.
Salt Lake City, Utah

4 November 1983

ABSTRACT

CRMS/BYU has completed a three-acre survey for expansion of U.S. Fuels mine facilities in Carbon County, Utah. No cultural resource materials were observed within the survey area, and CRMS recommends to the Utah State Historic Preservation Office that a cultural resource clearance be granted to Ford, Bacon and Davis, Inc. for this project.

TABLE OF CONTENTS

LIST OF FIRGUES

A CULTURAL RESOURCE INVENTORY OF MILLER CREEK SURFACE FACILITIES IN CARBON COUNTY FOR U.S. FUELS

INTRODUCTION

One 2 November 1983 Dean Schleisman, of the Cultural Resource Management Services (CRMS), Brigham Young University, conducted a cultural resource inventory of about 3 acres in Carbon County, Utah, for U.S. Fuels. The inventory area is the proposed location for new surface mine facilities for the expanding U.S. Fuels mine near Hiawatha, Utah. The work was requested by Dr. Jack Elder, of Ford, Bacon and Davis Inc., mine consultants for U.S. Fuels. The survey area is entirely on private land, hence no Federal or State permits were requested. Survey conditions were ideal and ground visibility excellent. The report was prepared by Dean Schleisman and Asa S. Nielson, and Ted Duffin processed the manuscript.

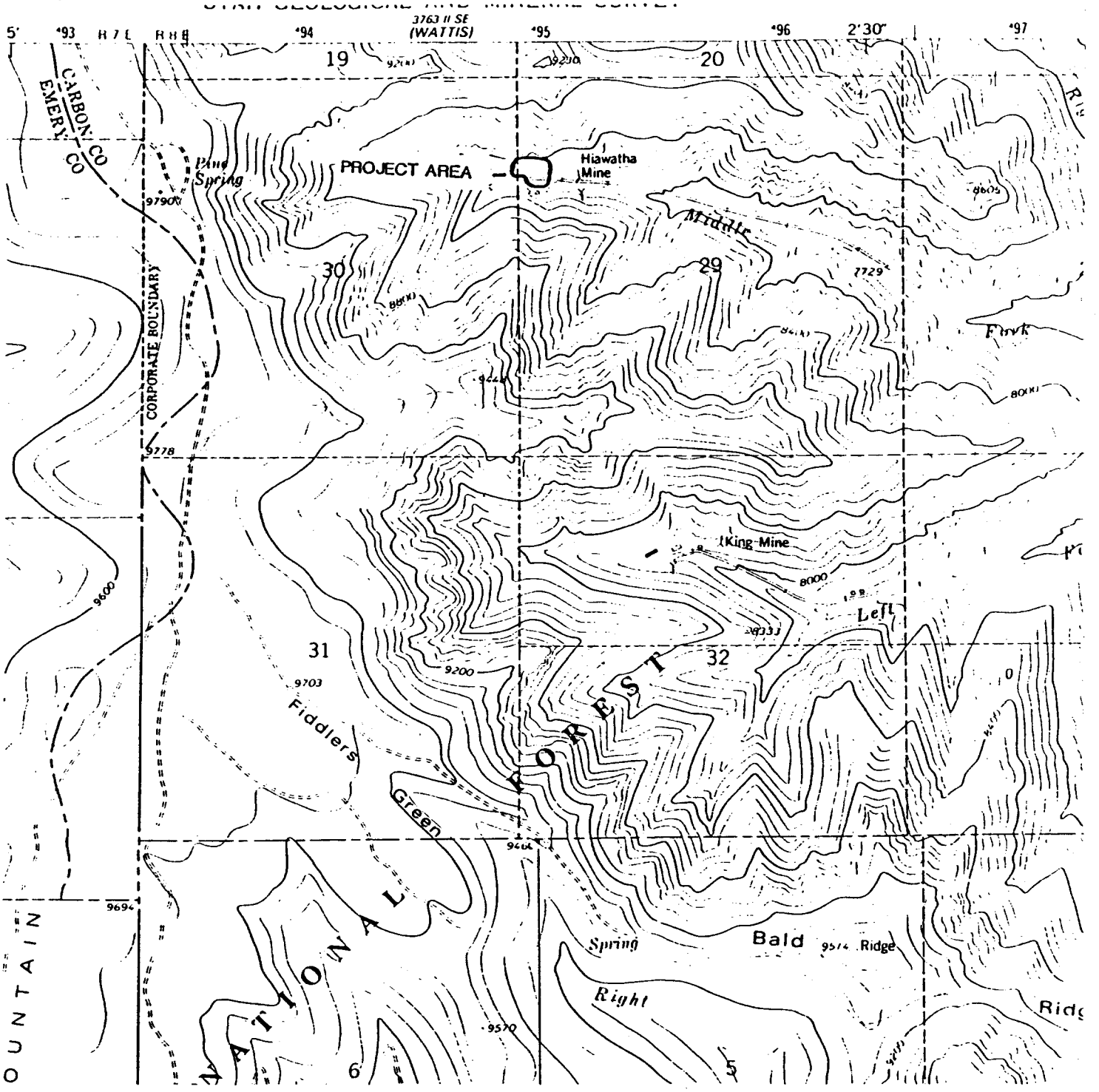
LOCATION

The proposed mine facility (Figure 1) is located about 2.7 miles due west of Hiawatha, Carbon County, Utah. It is in the upper portion of the Middle Fork of Miller Creek, in the SW1/4 NW1/4 NW1/4 of Section 29, T15S R8E (Hiawatha Quadrangle, Utah, 7.5-minute series topographic). Access to the area is by an existing road leading past the existing Hiawatha Mine.

ENVIRONMENT

The survey area is part of the Wasatch Plateau Subsection of the Basin and Range-Colorado Plateau Transition (Stokes 1977). This area is characterized by deeply entrenched east-to-west canyons which empty into the Mancos Shale Lowlands. Miller Creek has cut its was through successive layers of Cretaceous Black Hawk and Price River Formations, and Paleocene North Horn Formation (Hintze 1980). The mine area is predominantly Black Hawk Formation covered with a thin veneer of talus and colluvial soil. The canyon bottom has in excess of one meter of Recent alluvial deposits of sandy, rocky stream clays.

Flora observed was restricted to big sage, mountain mahogany, pinyon, scrub oak, broom grass and cactus. No fauna were directly observed in the survey area. However, tracks of mule deer and rabbit were observed.



SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

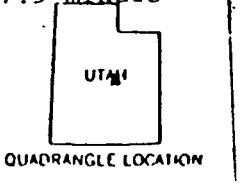
N

PROJECT: U.S. Fuels Hiawatha Mine Expansion **T.** 15S **R.** 8E

COUNTY: Carbon **QUAD:** Hiawatha, Utah 7.5-minute

LEGEND: Project Area

Figure 1



PREVIOUS RESEARCH

Overviews of the culture history of the area are available elsewhere and need not be repeated in detail here. In addition, Ford, Bacon and Davis Inc. is in the process of negotiating a complete overview of the Hiawatha area in addition to proposed additional survey next Spring. Records searches at the Utah Division of State History revealed no known cultural resources in the proposed mine facility area. Consultation with the State and National Registers of Historic Places also revealed no known National Register sites within the survey boundaries.

SURVEY METHODS

The survey was accomplished by completing several parallel transects back and forth over the area of proposed disturbance. Much of the surface is dominated by a moderate hill slope. All possible overhangs, level areas or other potential areas were examined.

SURVEY RESULTS

No cultural resource sites or isolated artifacts were noted during the inventory. The historic Hiawatha Mine is about 300 m due east, but will not be impacted by the new mine facilities. No significant cultural resources will be directly impacted; therefore, CRMS recommends to the Utah State Historic Preservation Office that a cultural resource clearance be granted for this phase of the project, with the following restrictions:

1. that personnel and equipment associated with the development be restricted to those areas cleared for the project:

2. that personnel associated with the project refrain from collecting or otherwise disturbing cultural materials which may be encountered during development; and

3. that should unreported cultural materials be encountered during development, activities in the affected area(s) should cease immediately and the Utah State Historic Preservation Office notified prior to resuming such activities.

BIBLIOGRAPHY

Hintze, Lehi F.
1980 Geologic Map of Utah. Utah Geological and Mineral Survey. Salt Lake City.

Stokes, William Lee
1977 Subdivisions of the Major Physiographic Provinces in Utah. Utah Geology 4(1). Utah Geological and Mineral Survey. Salt Lake City.

Appendix III - 13

APPENDIX III-13

King VI Interim Revegetation Plan

RECEIVED
MAR 1985
DIVISION OF
OIL, GAS & MINING

King VI Interim Revegetation Plan

The goal of this revegetation plan is to establish a permanent, effective and diverse vegetative cover, capable of self-regeneration and plant succession, for use as rangeland and wildlife habitat. A prompt vegetative cover will be established which, through time, will allow vegetative cover, woody plant density and productivity to recover to levels equal to the cover, density and productivity of reference areas. U.S. Fuel Company proposes an Interim Revegetation Plan to test individual species and a variety of steep slope revegetation methods. The Interim Revegetation Plan will provide information which will help determine the success and survivability of each species planted and whether or not introduced species can aid in establishing a diverse, effective and permanent cover compatible with postmining land use. A variety of steep slope revegetation methods will be tested during the interim to evaluate their effectiveness in soil stabilization and vegetative establishment.

Interim Revegetation Plan

Interim Revegetation efforts will begin soon after site preparation during the fall of 1982. The areas to be revegetated during the interim are listed in Table 1. These areas were formed during construction by clearing vegetation, cut and fill or excavation. The soils of these areas are a mixture of topsoil and subsoil (see Topsoil Plan) with slopes up to 90%. In addition to steep slopes, compaction of soils presents a problem to revegetation in the areas under the stacker conveyor and between the truck turnout and haul roads. A variety of steep slope revegetation methods and ripping to a depth of 14-16 inches during seedbed preparation will be used to alleviate these problems. The soil stabilization methods proposed consist of a variety of combinations of chemical tackifier, nylon netting and mulch. Each combination to be tested includes hydraulic application of seed (Attachment 1, 22 pounds pure live seed per acre), fertilizer (as per recommendations based on the results of soil tests) and chemical tackifier (140 pounds per acre). This application will be followed by one of these treatments:

1. Nylon netting oversprayed with wood fiber mulch (2000 pounds per acre) and chemical tackifier (120 lbs/acre).

2. Hydraulic application of straw mulch (1000 lbs/acre) with chemical tackifier (120 lbs/acre), overlaid with nylon netting, oversprayed with wood fiber mulch (1000 lbs/acre) and chemical tackifier (60 lbs/acre).

TABLE 1

Disturbed area (acres) in each vegetation type to be re-vegetated during the interim at the King VI mine.

Vegetation Type	LOCATION					
	Stacker Conveyor	Sediment Pond	Coal Pile	Truck Turnout	Conveyor	Total
Riparian	0.00	0.10	0.00	0.00	0.00	0.10
Pinyon-Juniper	0.00	0.00	0.15	0.40	0.20	0.75
Sagebrush	0.25	0.20	0.10	0.00	0.00	0.55
Total	0.25	0.30	0.25	0.40	0.20	1.40

3. Hydraulic application of straw mulch (2000 lbs/acre) with chemical tackifier (120 lbs/acre), overlaid with nylon netting.

4. Hydraulic application of wood fiber mulch (2000 lbs/acre) with chemical tackifier (120 lbs/acre).

Treatments 1 and 2 will be tested on the steeper slopes of the conveyor, coal pile and truck turnout areas. Treatments 3 and 4 will be tested on the less steep slopes of the truck turnout area, under the stacker conveyor, and on the sediment pond outslopes. Specific location of study plots will be determined in consultation with the Utah Division of Oil, Gas and Mining.

Interim revegetation will be monitored annually during the first five years, semi-annually during the second five years, and every third year thereafter until final reclamation. Monitoring will be conducted during the peak production period (late July to early August) when plant cover is near maximum and individual species are recognizable. Percent plant, litter, rock and bare ground cover will be ocularly estimated using a 0.5 m^2 rectangular quadrat. In addition, percent plant cover will be estimated for each individual species. The sample size for each treatment area will be adequate at 90% confidence with 10% precision using the following formula:

$$n = \frac{S^2 \, t^2}{D^2}$$

where, n = minimum sample size
t = t distribution for a given level of confidence
S^2= the variance estimate from preliminary sampling
D = level of accuracy desired for the estimate of the mean

ATTACHMENT 1

Seed Mix For Interim Revegetation

The following seed mix was developed to provide a variety of predominantly native species to be tested for their ability to survive and be successful in stabilizing the soil and establishing a diverse, effective and permanent vegetative cover. The seed mix is composed of grasses (bunchgrasses and sod formers), forbs, and shrubs adapted to the soils and climate of the King VI mine.

In addition to the seed mixture listed, U.S. Fuel Company requests approval from DOGM to include 10 pounds of rye and 10 pounds of barley to serve as a nurse crop.

Information from field tests will help determine whether or not the use of the introduced species can be justified for final reclamation. The introduced species were selected for their ease of establishment, erosion control and compatibility with post-mining land use.

Seed Mix For Interim Revegetation

Scientific and Common Name	% By Weight of Pure Live Seed
Native Grasses	
Agropyron riparium Streambank wheatgrass	7
Agropyron smithii Western wheatgrass	7
Agropyron trachycaulum Slender wheatgrass	7
Elymus cinereus Basin wildrye	7
Poa pratensis Kentucky bluegrass	2
Introduced Grasses	
Agropyron intermedium Intermediate wheatgrass	7
Elymus junceus Russian wildrye	7
Native Forbs	
Eriogonum umbellatum Sulfur flower	7
Hedysarum boreale Northern sweetvetch	7
Artemisia ludoviciana Louisiana sagebrush	2
Introduced Forbs	
Medicago sativa Alfalfa	7
Melilotus officinalis Yellow sweetclover	7

Scientific and Common Name	% By Weight of Pure Live Seed
Native Shrubs	
Artemisia tridentata wyomingensis Big sagebrush	2
Cercocarpus montanus True mountain mahogany	7
Chrysothamnus nauseosus albicaulis Rubber rabbitbrush	7
Ephedra viridis Green ephedra	10

usl orig.

BIO/WEST, Inc.
P.O. Box 3226
Logan, Utah 84321
(801) 752-4202

November 16, 1982

Mr. Charles J. Jahne
Sharon Steel Corporation
19th Floor, University Club Bldg.
136 East South Temple
Salt Lake City, UT 84111

Dear Mr. Jahne:

Interim revegetation efforts at the King VI Mine were completed on Wednesday, November 3, 1982. The newly-created topsoil stockpile and each of the areas listed in the Interim Revegetation Plan were: seeded at the rate of 42 lbs pure live seed per acre of the mix (including the nurse crop) outlined in the Interim Revegetation Plan; fertilized at the rate of 50 lbs/acre of nitrogen, 100 lbs/acre of phosphate, and 50 lbs/acre of potash; and tackified at the rate of 140 lbs/acre of chemical tackifier. The seed, fertilizer, and tackifier were hydraulically applied by B&R Reclamation Specialists (B&R) on Saturday, October 30, 1982.

Approximately one-half of the area along the conveyor, at the sediment pond and truck turnout, and of the outslopes of the sediment pond was overlaid with erosion control netting and oversprayed with wood fiber mulch (2,000 lbs/acre) and chemical tackifier (120 lbs/acre). The remainder of these areas was mulched with straw (hand applied at 1,000 lbs/acre), overlaid with erosion control netting, and oversprayed with wood fiber mulch (1,000 lbs/acre) and chemical tackifier (180 lbs/acre).

The top of the bank of the sediment pond and the newly-created topsoil stockpile were oversprayed with wood fiber mulch (2,000 lbs/acre) and chemical tackifier (120 lbs/acre).

The compacted areas at the truck turnout and near the stacker conveyor were "ripped" (by B&R) to a depth of about 16 inches on Saturday shortly before hydraulic application of the seed, fertilizer, and tackifier (detailed above). These areas were oversprayed with wood fiber mulch (2,000 lbs/acre) and chemical tackifier (120 lbs/acre). A small area near the stacker conveyor which had been disturbed, but not compacted, was mulched with straw (hand applied at 1,000 lbs/acre), overlaid with erosion control netting, and oversprayed with wood fiber mulch (1,000 lbs/acre), and chemical tackifier (180 lbs/acre).

B/W

The burlap covering the original topsoil stockpile was removed before hydraulic application of the seed, fertilizer and tackifier (detailed above). The stockpile was mulched with straw (hand applied at 2,000 lbs/acre) and overlaid with erosion control netting.

The wood fiber mulch and chemical tackifier were hydraulically applied by B&R on Wednesday, November 3, 1982.

Ms. Jean Semborski asked me to comment on your use of burlap. Burlap, as you used it, was a very effective means of controlling erosion and stabilizing the topsoil stockpile; however, it was a hindrance to plant growth and survival. I was surprised at the cover and density of the grasses under the burlap. As expected, though, most of the plants were in low vigor, judged by their color (pale green and yellow) and the fineness of their leaves. The low vigor was undoubtedly caused by the burlap covering which prevented sunlight from reaching the leaves. Without sunlight, the plants were forced to use carbohydrate reserves to maintain growth, rather than building up reserves as they normally would during the growing season. This winter, the leaves will die back to the crown of each plant and the plants will have to rely on carbohydrate reserves to stay alive. Since most of the plants have little or no reserves, they will die. It is my opinion that, although the burlap was effective at short-term erosion control, it as defeating the long-term erosion control and stabilizing effect of plant establishment and survival.

As I indicated in our telephone conversation yesterday, I will be out of town for the Thanksgiving holidays. If you have any questions or need any additional information, you can contact our secretary, Nancy, who will relay the message to me. Have a happy holiday.

Sincerely,

John Rice

John Rice
Vegetation/Soils Section Manager

JR/nh

cc: Jean Semborski, U.S. Fuel Company

Appendix III - 14

APPENDIX III-14

Calculations For Stream Crossing To Access Borrow Areas B and C

****
****

UNIVERSITY OF KENTUCKY COMPUTER MODEL
OF SURFACE MINE HYDROLOGY AND SEDIMENTOLOGY
FOR MORE INFORMATION CONTACT THE AGRICULTURAL
ENGINEERING DEPARTMENT

THE UK MODEL IS A DESIGN MODEL DEVELOPED TO PREDICT
THE HYDRAULIC AND SEDIMENT RESPONSE FROM SURFACE
MINED LANDS FOR A SPECIFIED RAINFALL EVENT (SINGLE STORM)

VERSION DATE 9-23-83

DISCLAIMER: NEITHER THE UNIVERSITY NOR ANY OF ITS EMPLOYEES
ACCEPT ANY RESPONSIBILITY OR LEGAL LIABILITY FOR THE
CONCLUSIONS DRAWN FROM THE RESULTS OF THIS MODEL

****
****

****

THE FOLLOWING VALUES ARE NOW PREDICTED BY SEDIMOT II.
THEY CAN BE FOUND IN SUMMARY TABLES.

1. PERIOD OF SIGNIFICANT CONCENTRATION
2. VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION
   DURING PERIOD OF SIGNIFICANT CONCENTRATION
3. VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION
   DURING PEAK 24 HOUR PERIOD
4. ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING
   PERIOD OF SIGNIFICANT CONCENTRATION
5. ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION
   DURING PEAK 24 HOUR PERIOD

ALL CONCENTRATIONS ARE IN ML/L.

****

WATERSHED IDENTIFICATION CODE

**********INPUT VALUES**********

STORM DURATION = 6.00 HOURS
PRECIPITATION DEPTH = 0.76 INCHES

1

* *
JUNCTION 1, BRANCH 1, STRUCTURE 1
* *

W A R N I N G

SUBWATERSHED AREA
IS NOT WITHIN THE EXPECTED LIMITS. THE
VALUE MUST BE NO SMALLER THAN 0.0 AND IF POSSIBLE SHOULD NOT EXCEED
5000.000. SEDIMOT WILL CONTINUE WITH THE VALUE ENTERED, 8808.0000 ,BUT IT
MAY CAUSE INACCURACIES OR EVEN TERMINATION LATER IN THE PROGRAM

*** HYDRAULIC INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	AREA ACRES	CURVE NUMBER	TC HR	TT HR	ROUTING COEFFICIENTS K-HRS	X	UNIT HYDRO
1	8808.00	75.00	1.320	0.0	0.0	0.0	1.0

* * * COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS * * *

WATERSHED	PEAK FLOW (CFS)	RUNOFF (INCHES)
1	10.79	0.00

NOTE: SEDIMENT DOES NOT INCLUDE POSSIBLE DEPOSITION BY DELIVERY RATIO 2

***** SUMMARY TABLE FOR TOTAL WATERSHED *****

RUNOFF VOLUME	=	1.8659	ACRE-FT
PEAK DISCHARGE	=	10.7933	CFS
AREA	=	8808.0000	ACRES
TIME OF PEAK DISCHARGE	=	6.30	HRS

* * * * * * * * * * * * *

NULL STRUCTURE

* * * * * * * * * * * * *

*** RUN COMPLETED ****

** END OF LISTING **********

Appendix III-15

File # ACT/007/011
Copy # 26
Insert into: Work Copy of PAP as indicated

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527

July 29, 1985

Mr. D. Wayne Hedberg, Permit Supervisor/Reclamation Hydrologist
State of Utah, Division of Oil, Gas and Mining
355 W. North Temple, 3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RECEIVED
JUL 31 1985
DIVISION OF OIL
GAS & MINING

RE: Approval of Plan For The Abatement of N84-4-8-8, 8 of 8.

Dear Mr. Hedberg:

Pursuant to your July 16, 1985 letter requesting eleven copies of the Dec. 14, 1984 road plan appropriately modified, United States Fuel Company is submitting the requested copies. This revised plan, dated July 26, 1985, and entitled, "Middle Fork Road Drainage and Erosion Control" is prefaced by an appendix page so that the plan may be directly inserted into the appendices of revised Chapter III text.

This submittal then should satisfy the final measures required before full approval is granted by the Division. Construction of the items outlined in the revised plan will be accomplished by Sept. 1, 1985.

We would like to recieve a formal, complete approval of our plan once you have reviewed it but before the Sept. 1, 1985 deadline date.

APPROVED N.O.V. ABATEMENT PLAN

To Approved Mining & Reclamation Plan
Division of Oil, Gas & Mining

by DW Hedberg date 13 July 85

Reviewer D. Hooper

Sincerely,

Jean Semborski

Jean Semborski
Engineer

Enclosure

RECEIVED

JUL 3 1 1985

DIVISION OF OIL
GAS & MINING

Important: Insert this Appendix III-15 behind Appendix III-14 in the reorganized permit application.

APPROVED N.O.V. ABATEMENT PLAN

To Approved Mining & Reclamation Plan
Division of Oil, Gas & Mining

by DW Hedberg date 13 July 85

reviewer D. Hooper

APPENDIX III-15

Middle Fork Road Drainage And Erosion Control

Revised July 26, 1985

Previous cover

ABATEMENT PLANS FOR NOTICE OF VIOLATION N84-4-8-8, NO. 8 OF 8 MIDDLE FORK ROAD DRAINAGE AND EROSION CONTROL HIAWATHA COMPLEX

Submitted to

UTAH DIVISION OF OIL, GAS, AND MINING
Salt Lake City, Utah

Submitted by

UNITED STATES FUEL COMPANY
Hiawatha, Utah

APPROVED N.O.V. ABATEMENT PLAN
To Approved Mining & Reclamation Plan
Division of Oil, Gas & Mining
by DW Hedberg date 13 Jun 85
reviewer D. Hooper

December 14, 1984

I hereby certify that this document has been prepared under my direction and that it is technically correct to the best of my knowledge.

REGISTERED PROFESSIONAL ENGINEER
3358
John Kurt Jardine
STATE OF UTAH

J Jardine

TABLE OF CONTENTS

ABATEMENT PLANS FOR NOTICE OF VIOLATION N84-4-8-8, No. 8 of 8, MIDDLE FORK ROAD DRAINAGE AND EROSION CONTROL, HIAWATHA COMPLEX

INTRODUCTION

The information contained in this report is submitted to the Utah Division of Oil, Gas and Mining by United States Fuel Company in response to Notice of Violation N84-4-8-8, No. 8 of 8. This violation deals with drainage and runoff control along the Middle Fork road accessing the King IV and V mines. The report also addresses concerns raised by the Division in letters to United States Fuel Company dated August 2, 1984, May 3, 1985, July 2, 1985 and July 8, 1985.

This submittal is a compilation of all pertinent previous submittals related to the Middle Fork road drainage plan and includes supplemental work agreed to be performed by U.S. Fuel Company which was outlined in the Division's letters of July 2 and July 8, 1985.

CULVERT SPACING

Currently, seven ditch-relief culverts exist along the Middle Fork road between Hiawatha and the mine yard (culverts 27, 28, 30, 31, 32, 33, and 34). In addition, two culverts (13 and 29) are installed under the Middle Fork road where it crosses the South Fork and Middle Fork of Miller Creek, respectively. The ditch-relief culverts divert water from undisturbed areas upstream from the road to the Middle Fork of Miller Creek. As noted in the Division letter of August 2, a total of 27 culverts are required along the Middle Fork road according to UMC 817.153(c) unless it can be shown that a fewer number of culverts can be used and still maintain nonerosive conditions in the roadside ditches.

Calculations to determine the velocity of flow in the roadside ditches during runoff from the 10-year, 24-hour storm are contained in Appendix A of this report. These calculations are summarized in Table 1. As noted in this table, with the existing culvert spacing, no velocities during the 10-year, 24-hour storm exceed 5.0 feet per second, the maximum permissible velocity to maintain nonerosive conditions in gravelly loams as found at the site (U.S. Environmental Protection Agency, 1976). As a result, the existing culvert spacing is adequate for maintenance of non-erosive conditions.

Table 1. Velocities in roadside ditches above culverts along the Middle Fork road during the 10-year, 24-hour storm.

Culvert Number	Velocity (ft/s)
27	4.4
28	3.0
30	3.0
31	4.0
32	3.3
33	4.8
34	2.7
(a)	3.0

(a) Section from culvert 34 to survey station 0+00

PROTECTION OF CULVERT OUTLETS

Channel erosion has occurred between the Middle Fork of Miller Creek and the outlets of culverts 28, 30, 31, 32, 33, and 34. No erosion is apparent below the outlets of culverts 13, 27, and 29. To aid in alleviating future erosion problems, rigid downspouts will be installed on culverts 28, 30, 31, 32, 33, and 34. These downspouts will be constructed of corrugated metal pipe of the same diameter as the existing culvert and will extend from the culvert outlets to the bottom of the channels that lead from the culverts to the Middle Fork. Two 45° elbows will be provided on each downspout (one at the existing culvert outlet and one at the channel bottom) to direct the water from the culverts to a line parallel to the bottom of the channels leading to the Middle Fork.

For culverts 30, 31, and 32, downspouts will be 5 to 10 feet in length. For culvert 28, approximately 40 feet of downspout will be required. The downspouts will be of the same diameter as the culverts and will be installed according to manufacturer instructions.

The exit channels below culverts 33 and 34 are not conducive to additional stabilization measures besides installation of downspouts. As a result, the downspouts on these culverts will be extended to the main stream channel. This will require the addition of about 35 feet of downspout below culvert 33 and 135 feet of downspout below culvert 34.

In addition to the rigid downspouts, loose-rock check dams will be provided in the outlet channels below culverts 28, 30, 31, and 32. Check dams are not required below culverts 33 or 34 since these culverts will be extended to the main stream channel. Additional channel stabilization is also not required below culverts 13, 27 and 29 since there are no signs of erosion at the outlets of these channels.

All loose-rock check dams have been designed according to criteria developed by Heede (1976) as noted in Appendix C. Locations of the check dams are shown in Appendix C.

Salient design features of the loose-rock check dams are summarized in Figure 1 and Table 2. The number of check dams in each outlet channel was based on the criterion that a dam be located near the upstream toe of the final sediment deposits of the next dam downstream.

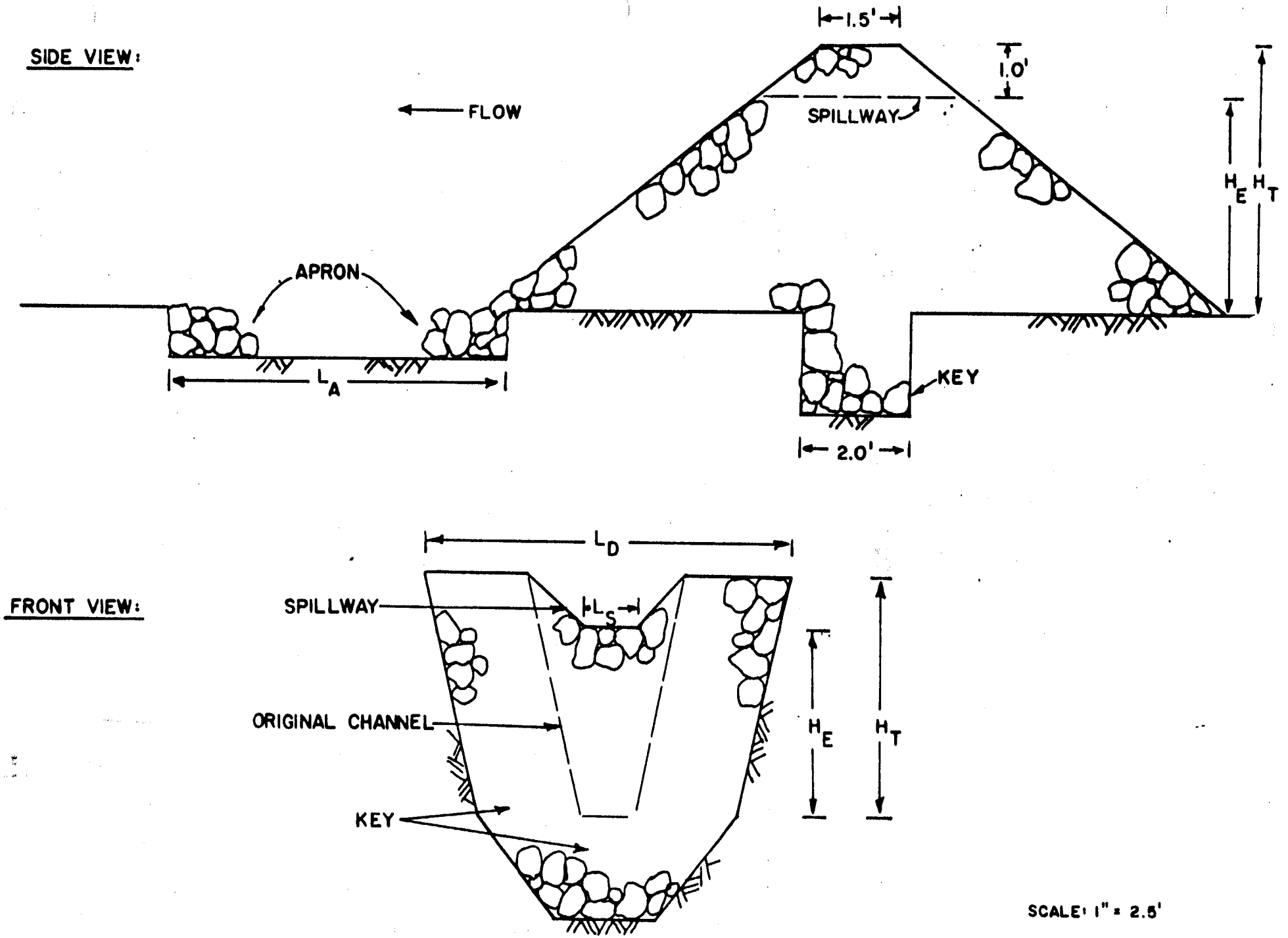


Figure 1. Typical Loose-Rock Check Dam.

Table 2. Design summary for loose-rock check dams (see Appendix C for details).

Culvert No.	Downspout Length (ft)		No. of Check Dams	Check Dam Dimensions (ft)(a) H_T	H_E	L_S	L_D	L_A
28	40	36"	8	5.0	4.0	1.0	7.0	6.0
30	10	24"	1	7.0	6.0	3.0	9.0	10.5
31	10	24"	3	2.5	1.5	2.0	8.0	2.6
32	10	24"	9	2.5	1.5	2.0	8.0	2.6

(a) See Figure 1 for explanation of symbols

All check dams will be keyed into the bottom and sides of the existing channel. The keys will be 2 feet wide and extend 2 feet into the channel bottom and side. Material excavated from the keys will be placed in the channel bottom immediately below the existing culvert outlet (i.e., beneath the downspout) to provide a base for the downspout.

Riprap used for construction of the check dams will consist of angular to subangular sandstone. Grading of the riprap will be as follows:

Size (in)	Percent Finer
12.0	100
10.0	60
8.0	48
4.0	30
1.0	10

Each check dam will be constructed using a backhoe to excavate the keys and place the riprap. The slope of the upstream and downstream faces of the check dams will be equal to the angle of rest for the riprap (1.25:1.00 for angular stone - see Heede, 1976). Each check dam will have a top width of 1.5 feet.

An apron will be provided in the channel bottom below each chech dam to prevent scouring of the channel below the dam. The length of this apron will be 1.5 times the effective height of the dam (measured from the toe of the dam) for dams in the channel below culvert 28 (with a slope of less than 15 percent)

and 1.75 times the effective height of the dam in other channels (where the channel slope exceeds 15 percent).

The channel bottom will be excavated to a depth of 12 inches prior to placement of the apron. Riprap used for the apron will be placed in the excavated channel bottom to such a depth that the top of the apron is level with the original channel bottom. The same riprap used for check-dam construction will be used for the aprons.

Bank protection will be provided below each check dam by excavating the channel sides to a depth of 12 inches to the total height of the dam. The same riprap used for the check dams will be placed in the excavated sides to the total length of the apron.

Each check dam will be inspected semiannually for structural integrity until the storage space behind the dams has filled with sediment. Structural problems will be repaired immediately. Because the purpose of the check dams is to stabilize the outlet channels (i.e., trap sediment and permanently retain it, thereby preventing additional downcutting and sediment contributions from the outlet channels to the Middle Fork stream), periodic dredging of the sediment behind the dams will not be required.

ADDITIONAL CONSIDERATIONS

The roadside ditch at the toe slope of the Middle Fork road will be regraded for debris and sediment removal once each year following the snow removal season. In addition, the outslope of the road, from below the Middle Fork sediment pond to the South Fork drop culvert inlet, will be graded along the shoulder once each year following the snow removal season. This will remove debris that has accumulated during the previous year from resurfacing and snow removal activities. Removal of this debris will also result in the elimination of berms that form along the top of the outslope, thereby precluding channelization of runoff along the shoulder and eventual discharge at a concentrated point. Material that is removed from the annual grading of the road edges will be removed and placed in the refuse disposal area or used for fill in other areas of the operation as needed.

There are several areas near the guardrail supports by culvert #29 where the gullys have become quite large, enough so to accommodate a lining of riprap from the road shoulder to down below the road bed. The riprap will be similar in size to that used in the check dams.

Following annual grading operations, a visual inspection will be made of the roadside ditche to ensure that culvert inlets are free from accumulated debris. Any excessive debris at the inlets will be removed and disposed of as outlined previously.

Non-concentrated water that flows down the outslopes of the road will be filtered by the vegetative buffer strip that currently exists between the road and the Middle Fork stream channel. This buffer strip will be periodically inspected to ensure adequate filtering.

Snow removal operations in the Middle Fork yard will be conducted to preclude the accumulation of coal fines and other debris along the road. All snow removed from the yard area and truck loadout facility will be pushed to an area that drains to the sedimentation pond. No snow will be piled in a location that will allow subsequent snow melt to bypass the pond.

The area immediately downstream from the sedimentation pond on the bank of the Middle Fork that was previously used for storage has been reclaimed. This area will not be used for future equipment or snow storage.

In order to control erosion and minimize the sediment contributed to the South Fork drainage culvert (located at the junction of the South Fork and Middle Fork roads) the eroded section of the ditch will be riprapped. The riprap material will be approximately one foot in diameter and installed in the ditch to provide protection for the eroded section. The riprapped section which is approximately three feet wide and 6 to 8 feet long will protect this section plus serve as a catchment trap for additional sediment.

REFERENCES

Heede, B.H. 1976. Gully Development and Control: The Status of Our Knowledge. USDA Forest Service Research Paper RM-169. Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado.

U.S. Environmental Protection Agency. 1976. Erosion and Sediment Control: Surface Mining in the Eastern U.S. EPA-625/3-76-006. Cincinatti, Ohio.

APPENDIX A

Calculations Supporting Spacing of Culverts on the Middle Fork Road

MIDDLE FORK ROAD CULVERT SPACING
U.S. FUEL COMPANY

Applicable regulation → UMC 817.153 (c)

All ditch-relief culverts have end areas less than 35 ft² (i.e., d < 80 in). Hence, the design storm is the 10-yr, 24-hr storm.

Maximum permissible velocity to prevent erosion in roadside ditches:

Soil in ditches → gravelly loamy sand
Maximum permissible velocity → 5.0 ft/sec
(U.S. EPA, 1976). "graded loam to gravel"

Runoff from the 10-yr, 24-hr storm (see PAP submitted by U.S. Fuel Co. in March 1981 – Chapter VII; Section 7.5, VII-1):

Culvert No.	Peak Flow[a] (cfs)
13[b]	149.4
27	3.5
28	1.6
29[b]	88.1
30	1.6[c]
31	2.3
32	1.4
33	7.1
34	31.1

(a) Represents all flow at culvert inlet, some of which flows directly into the culverts and not through the ditches. Hence, the values shown are conservative estimates for the ditches.

(b) Installed on the stream proper, not on a roadside ditch

(c) Original peak flow calculation in PAP in error. This is a revised value as shown on page 2 of this calculation.

10-yr, 24-hr storm runoff (From PAP, Chapter VII, Section 7.5, VII-1)

Original area in error by a factor of 10. See drainage area map on page 7 of this calc. for confirmation.

Culvert No.	A	CN	L	Y	Computed T_p	Hydro. Flow No.	P	Q	T_o	T_o/T_p Computed	T_o/T_p Used	$(T_p)_{equiv}$	$\frac{AEAQ}{(T_p)_{10L}}$	T_p
25	0.534	70	4980	58.6	0.23	4	2.25	0.34	12.3	53.5	50	0.25	351.5	16.3
26	0.806	70	7570	44.0	0.38	4	2.25	0.34	12.3	32.4	36	0.34	370.1	26.2
27	0.077	75	3300	35.6	0.19	4	2.25	0.51	12.5	65.8	50	0.25	76.0	3.5
28	0.036	75	2100	46.4	0.11	4	2.25	0.51	12.5	113.6	50	0.25	35.5	1.6
29	1.94	75	13,950	54.5	0.48	4	2.25	0.51	12.5	26.0	25	0.50	957.7	88.1
30	~~0.036~~ ~~0.364~~	75	2100	75.9	0.09	4	2.25	0.51	12.5	138.9	50	0.25	~~35.5~~ ~~369.4~~	~~1.6~~ ~~16.7~~
31	0.050	75	2100	54.6	0.11	4	2.25	0.51	12.5	113.6	50	0.25	49.4	2.3
32	0.031	75	1600	65.4	0.08	4	2.25	0.51	12.5	156.2	50	0.25	30.6	1.4
33	0.156	75	3700	65.0	0.15	4	2.25	0.51	12.5	83.3	50	0.25	154.0	7.1
34	0.684	75	8770	35.7	0.41	4	2.25	0.51	12.5	30.2	25	0.50	337.7	31.1
35	0.238	85	5370	28.0	0.23	3	2.25	0.98	14.7	63.9	75	0.20	661.4	37.6
36	0.0[illegible]	70	2700	61.2	0.12	1	2.25	0.24	12.3	102.5	50	0.25	39.5	1.8

Notes

A = area (mi^2)
CN = runoff curve number
L = hydraulic length of basin (ft)
Y = avg. slope (%)
T_p = time to hydrograph peak

$L = \frac{(2^{0.8})(S+1)^{0.7}}{1900\sqrt{0.5}}$

$S = \frac{1000}{CN} - 10$

Q = runoff volume (in)
T_o = duration of excess rainfall (hr)
q = peak flow (cfs)

SUBJECT DIMENSIONLESS HYDROGRAPH COMPUTATIONS

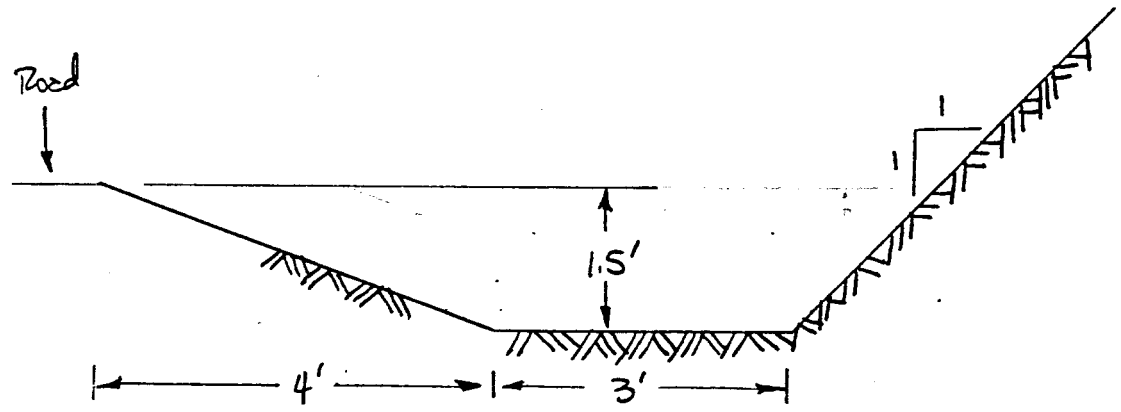
DATE 23 Jan 80 CHECKED BY ____ DATE ____

FILE NO. ____

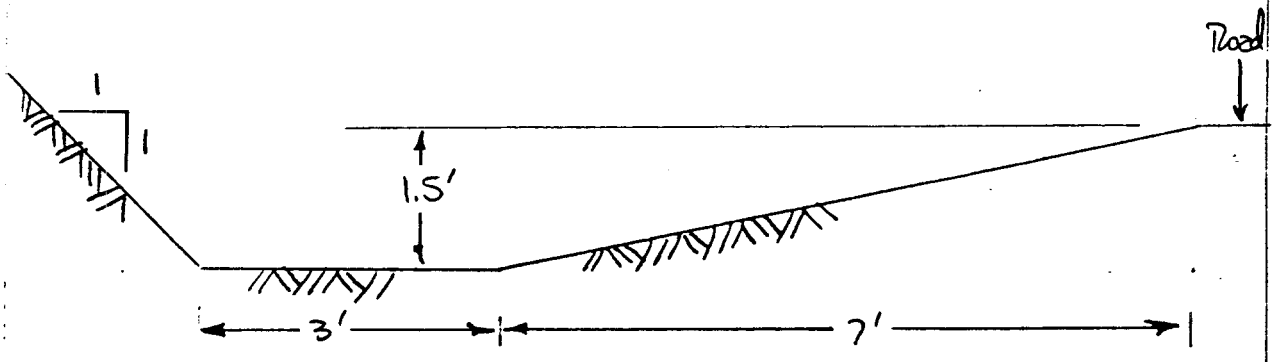
JOB NO. ____

SHEET 3 OF 5 2/16

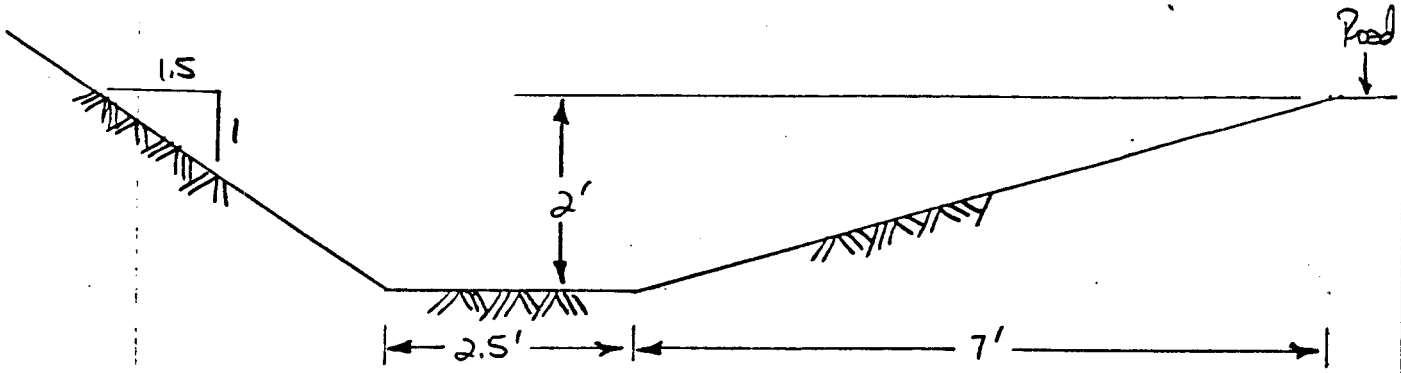
Ditch cross sections (scale: 1" = 2'):



① TYPICAL SECTION ABOVE CULVERTS 33, 32, & 31
(LOOKING UPSTREAM)



② TYPICAL SECTION ABOVE CULVERTS 30 & 28



③ TYPICAL SECTION BETWEEN CULVERT 28 AND
STATION 0+00

Stage-velocity calculations:

Use Manning's equation → $V = \frac{1.486}{n} R^{2/3} S^{1/2}$

where V = velocity (ft/s)
n = roughness coefficient
R = hydraulic radius (ft) = A/P
A = flow area (ft^2)
P = wetted perimeter (ft)
S = hydraulic slope (ft/ft)

For Middle Fork roadside ditches → n = 0.033
(value for unlined channel w/ earth bottom, rubble sides from U.S. SCS, 1986).

Velocity-discharge relation:

$q = AV$ (Q = discharge in ft^3/s)

Calculations for cross section ① (ditch above culverts 31-33):

S = 0.082 ft/ft

For depth (d) = 0.1 ft

P = 3.2 ft
A = 0.31 ft^2
R = 0.10 ft

$V = \left(\frac{1.486}{0.033}\right)(0.10)^{2/3}(0.082)^{1/2}$

$= 2.8$ ft/s

$q = (2.8)(0.31) = 0.85$ ft^3/s

For d = 0.3 ft

P = 3.9 ft
A = 1.0 ft^2
R = 0.26 ft

$V = \left(\frac{1.486}{0.033}\right)(0.26)^{2/3}(0.082)^{1/2}$

$= 5.2$ ft/s

$q = 5.2$ ft^3/s

Cross section ① (cont.)

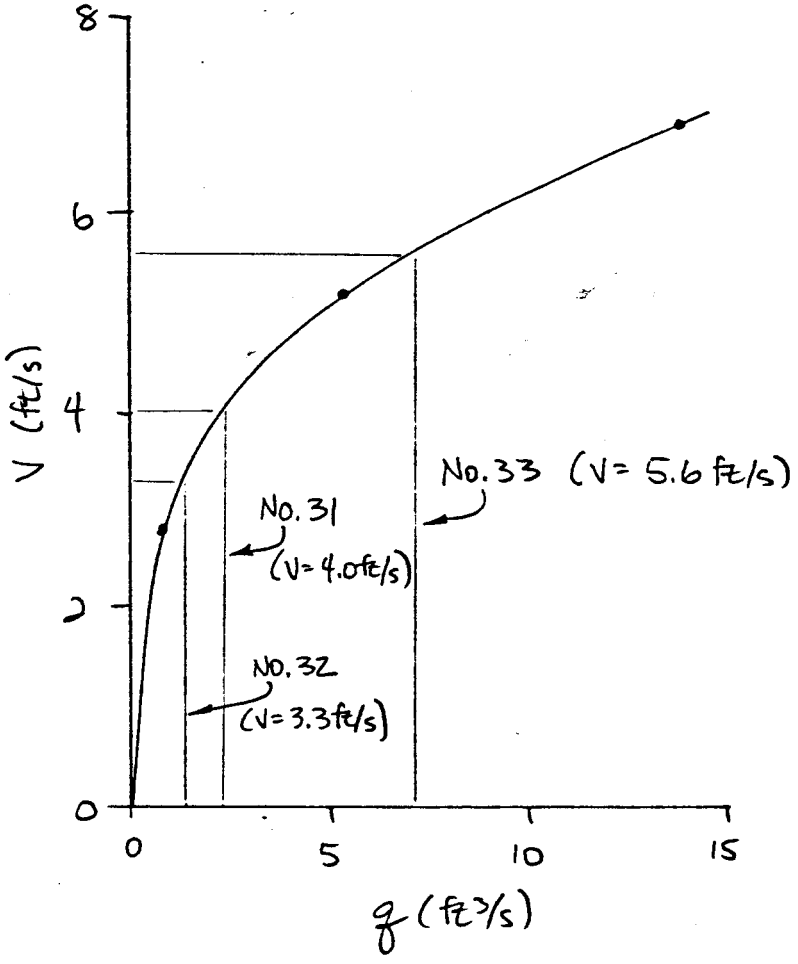
For d = 0.5 ft

P = 5.1 ft
A = 2.0 ft²
R = 0.39 ft

$$V = \left(\frac{1.486}{0.033}\right)(0.39)^{2/3}(0.08)^{1/2}$$

$$= 6.9 \text{ ft/s}$$

$$q = 13.8 \text{ ft}^3/\text{s}$$



Indicated velocity is sufficiently low for ditches above culverts 31 and 32. However, the velocity in the ditch above culvert 33 exceeds the maximum permissible velocity of 5.0 ft/s.

The discharge rates used to determine flow velocities in the roadside ditches above the culverts during the 10-yr, 24-hr storm were for the entire watershed above the culvert inlet. Excluding that portion of the watershed that discharges directly into culvert 33 without flowing through the ditch, a revised discharge rate was calculated (see next page)

Discharge rate for roadside ditch above culvert 33 (10-yr, 24-hr storm):

See attached map for drainage area

See methodology in PAP, Chapter VII; Section 7.5, VII-1 (see also U.S. SCS, 1972)

$A = 56.9$ acres $= 0.089$ mi^2

$CN = 75$ (from PAP, Chapter VII; Section 7.5, VII-1)

$l = 3500$ ft

$$Y = \frac{(8450\text{ ft})(160\text{ ft})}{(56.9\text{ ac})(43{,}560\text{ ft}^2/\text{ac})} = 0.546 \Rightarrow 54.6\%$$

$$L = \frac{(l^{0.8})(s+1)^{0.7}}{1900\, Y^{0.5}} \qquad s = \frac{1000}{CN} - 10 = 3.33$$

$$= \frac{(3500)^{0.8}(3.33+1)^{0.7}}{(1900)(54.6)^{0.5}}$$

$$= 0.14 \text{ hr}$$

$T_p = 1.17\, L = 0.16$ hr

Hydrograph Family No. $\longrightarrow$ 4 (see attached chart)

$P = 2.25$ inches

$$Q = \frac{(P - 0.2s)^2}{P + 0.8s} = 0.51 \text{ inch}$$

$T_0 \longrightarrow 0.2s = 0.67$ in. (initial abstraction)

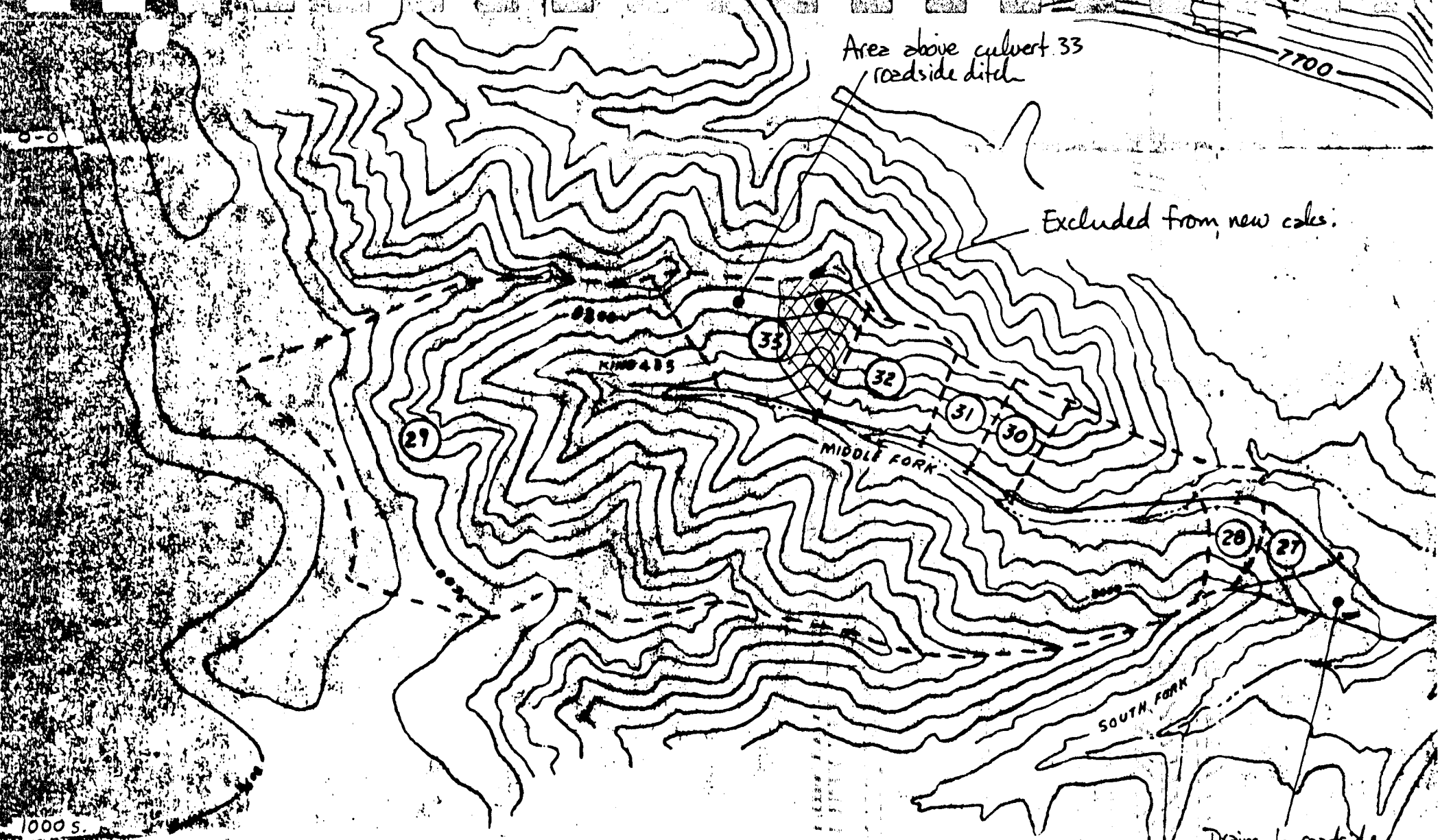
$\frac{0.67}{2.25} = 0.30$ (fraction of storm duration before runoff begins)

$T_0 = 24.0 - 11.5 = 12.5$ hr (see attached dist. curve, Type II storm)

Computed $T_0/T_p = 78.1$ (Use $T_0/T_p = 50$)

Revised $T_p = (12.5/50) = 0.25$ hr

Dimensionless $f = \frac{484AQ}{(T_p)_{rev}}$



MIDDLE FORK WATERSHED AREAS

SCALE 1" = 2,000'

CONTOUR INTERVAL 160'

(27) WATERSHEDS RELATING TO GIVEN CULVERTS

SEE TABLE XIII-2 FOR RUNOFF CALCULATIONS

From Exhibit XIII-2A (PAP)

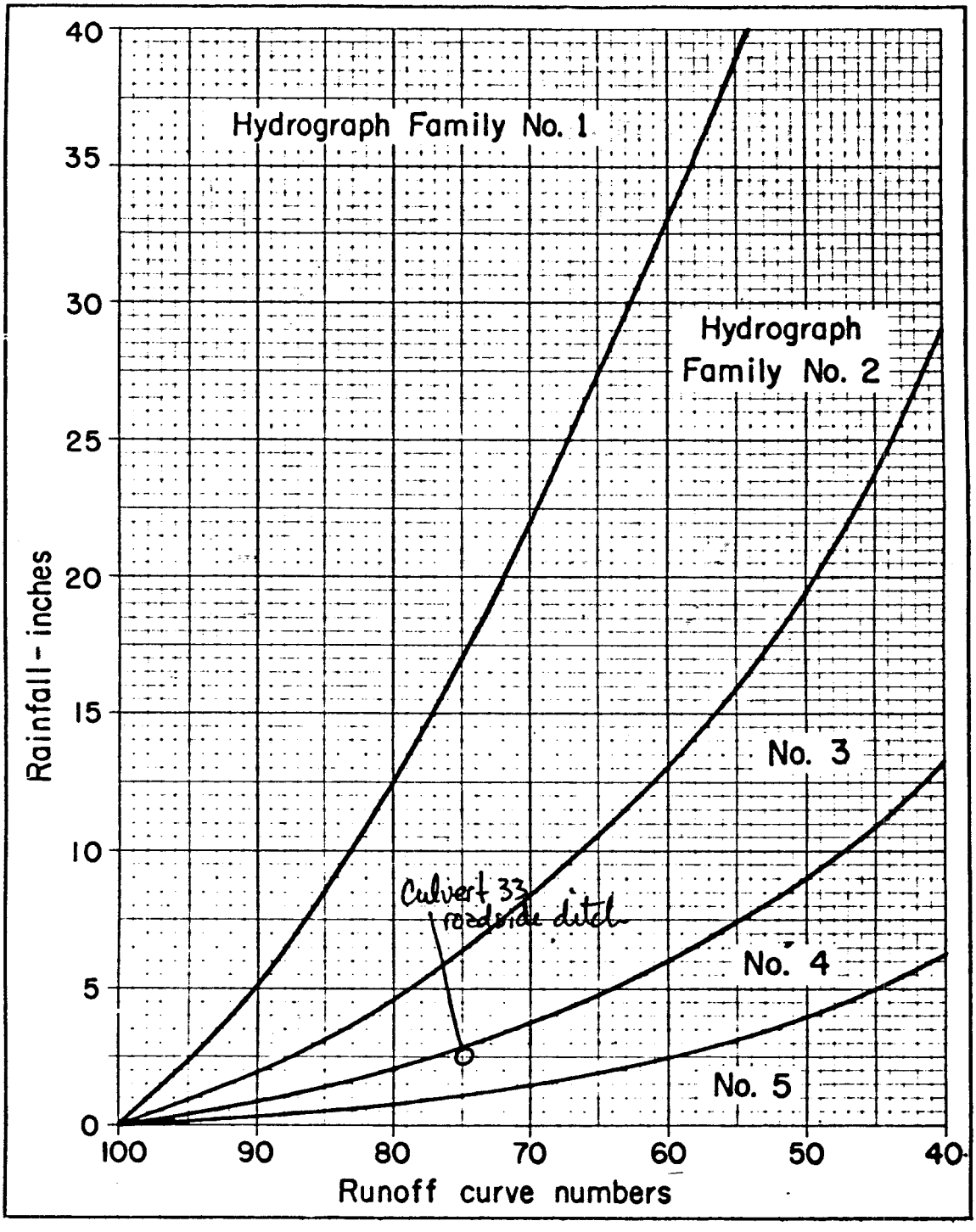


Figure 21-3. Chart for selecting a hydrograph family for a given rainfall and runoff curve number.

Source: U.S. SCS, 1972

For Hydro. Family No. 4, $T_o/T_p = 50$:

Max. rate factor = 0.0464 (see attached table)

$$q_{peak} = (87.9)(0.0464)$$

$$= 4.1 \text{ cfs}$$

For a discharge rate of 4.1 cfs, the velocity of flow in the roadside ditch will be 4.8 ft/s (see curve on page 5 of this calculation set). This is less than the maximum permissible velocity of 5.0 ft/s.

The foregoing calculations indicate that, with the present culvert spacing, the peak velocity of flow during the 10-yr, 24-storm in the roadside ditches above culverts 31, 32, and 33 is less than the maximum permissible velocity for erosion protection. Thus, these culverts are adequately spaced to provide control of the 10-yr, 24-hr storm runoff under nonerosive conditions.

Calculations for cross section ② (above culverts 28 and 30):

$s = 0.074$ ft/ft

For $d = 0.1$ ft

$P = 3.6$ ft

$A = 0.33$ ft

$R = 0.09$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.09)^{2/3}(0.074)^{1/2}$$

$$= 2.4 \text{ ft/s}$$

$$q = (2.4)(0.33) = 0.80 \text{ ft}^3/\text{s}$$

For $d = 0.3$ ft

$P = 4.9$ ft

$A = 1.2$ ft^2

$R = 0.24$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.24)^{2/3}(0.074)^{1/2}$$

$$= 4.7 \text{ ft/s}$$

$$q = (4.7)(1.2) = 5.6 \text{ ft}^3/\text{s}$$

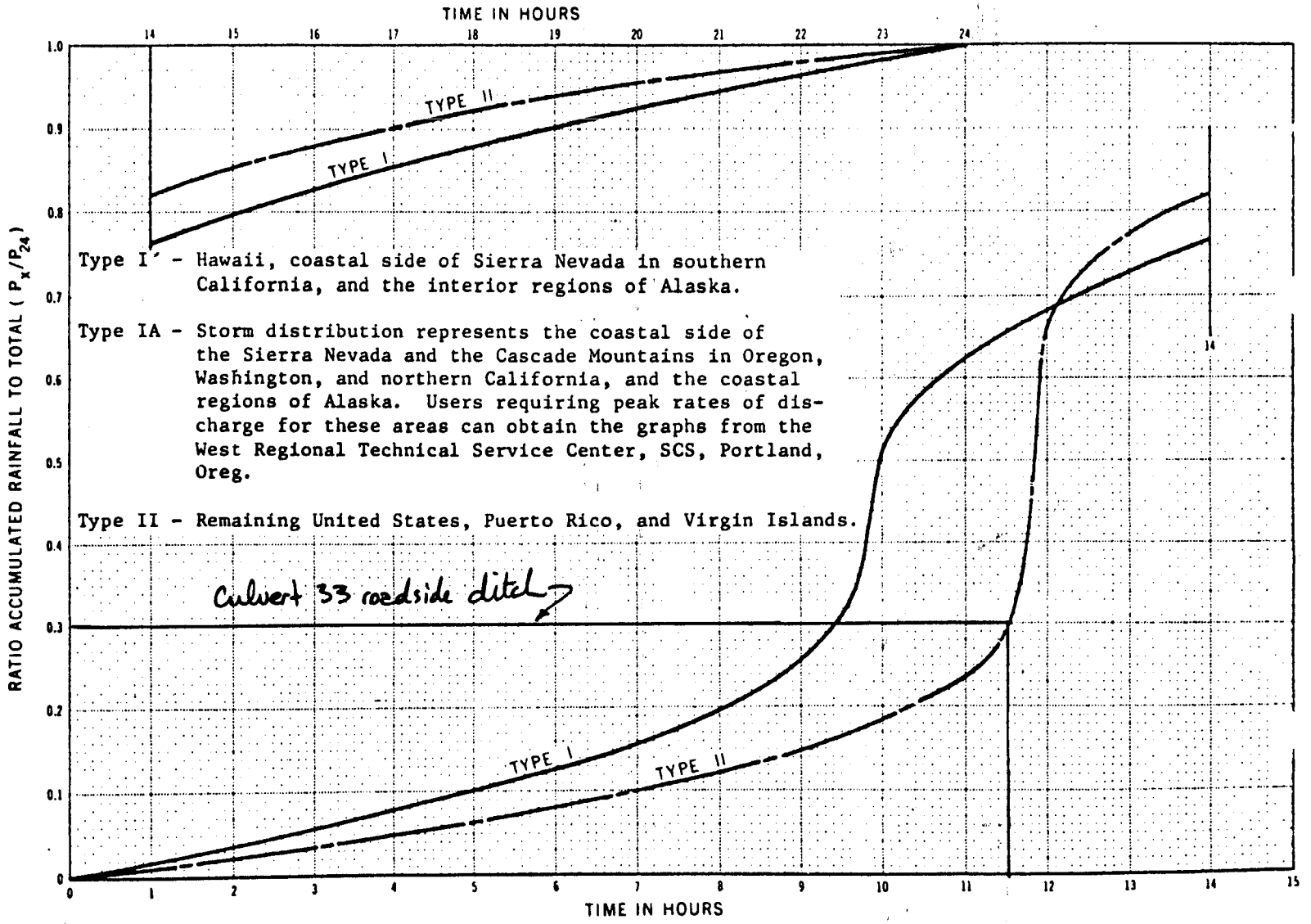


Figure 1.—Twenty-four-hour rainfall distributions (SCS).

Source: Kent (1973)

2

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For Hydro. Family No. 4, $T_o/T_p = 50$:

Max. rate factor = 0.0464 (see attached table)

$$q_{peak} = (87.9)(0.0464)$$

$$= 4.1 \text{ cfs}$$

For a discharge rate of 4.1 cfs, the velocity of flow in the roadside ditch will be 4.8 ft/s (see curve on page 5 of this calculation set). This is less than the maximum permissible velocity of 5.0 ft/s.

The foregoing calculations indicate that, with the present culvert spacing, the peak velocity of flow during the 10-yr, 24-storm in the roadside ditches above culverts 31, 32, and 33 is less than the maximum permissible velocity for erosion protection. Thus, these culverts are adequately spaced to provide control of the 10-yr, 24-hr storm runoff under nonerosive conditions.

Calculations for cross section ② (above culverts 28 and 30):

$s = 0.074$ ft/ft

For $d = 0.1$ ft

$P = 3.6$ ft

$A = 0.33$ ft

$R = 0.09$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.09)^{2/3}(0.074)^{1/2}$$

$$= 2.4 \text{ ft/s}$$

$$q = (2.4)(0.33) = 0.80 \text{ ft}^3/\text{s}$$

For $d = 0.3$ ft

$P = 4.9$ ft

$A = 1.2$ ft^2

$R = 0.24$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.24)^{2/3}(0.074)^{1/2}$$

$$= 4.7 \text{ ft/s}$$

$$q = (4.7)(1.2) = 5.6 \text{ ft}^3/\text{s}$$

Table 21.17 (Continued)

Hydrograph Family 4 | Hydrograph Family 5

Line No.	T_o/T_p = 36			T_o/T_p = 50			T_o/T_p = 1		
	t/T_p	q_c/q_p	Q_t/Q	t/T_p	q_c/q_p	Q_t/Q	t/T_p	q_c/q_p	Q_t/Q
1	0	0	0	0	0	0	0	0	0
2	1.50	.0306	.017	2.00	.0277	.020	.26	.021	.002
3	3.00	.0575	.066	4.00	.0464	.075	.52	.106	.014
4	4.50	.0672	.135	6.00	.0435	.141	.78	.289	.052
5	6.00	.0492	.199	8.00	.0378	.201	1.04	.530	.131
6	7.50	.0433	.251	10.00	.0335	.254	1.30	.740	.254
7	9.00	.0418	.298	12.00	.0307	.301	1.56	.848	.407
8	10.50	.0408	.344	14.00	.0291	.345	1.82	.767	.563
9	12.00	.0400	.388	16.00	.0282	.388	2.08	.590	.693
10	13.50	.0391	.432	18.00	.0274	.429	2.34	.406	.789
11	15.00	.0382	.475	20.00	.0266	.468	2.60	.279	.855
12	16.50	.0371	.517	22.00	.0258	.507	2.86	.193	.901
13	18.00	.0358	.557	24.00	.0250	.544	3.12	.134	.933
14	19.50	.0341	.596	26.00	.0242	.581	3.38	.092	.954
15	21.00	.0319	.632	28.00	.0234	.616	3.64	.065	.969
16	22.50	.0308	.667	30.00	.0230	.650	3.90	.044	.980
17	24.00	.0306	.701	32.00	.0229	.683	4.16	.030	.987
18	25.50	.0306	.735	34.00	.0227	.718	4.42	.021	.992
19	27.00	.0306	.769	36.00	.0226	.751	4.68	.015	.995
20	28.50	.0306	.803	38.00	.0225	.784	4.94	.009	.998
21	30.00	.0306	.837	40.00	.0224	.817	5.20	.005	.999
22	31.50	.0306	.871	42.00	.0222	.850	5.46	.002	1.000
23	33.00	.0306	.905	44.00	.0221	.883	5.72	0	1.000
24	34.50	.0306	.939	46.00	.0219	.915			
25	36.00	.0306	.973	48.00	.0219	.948			
26	37.50	.0085	.994	50.00	.0217	.980			
27	39.00	.0009	1.000	52.00	.0029	.998			
28	40.50	0	1.000	54.00	0	1.000			

Source: U.S. SCS, 1972

For $d = 0.5$ ft

$P = 6.1$ ft
$A = 2.2$ ft^2
$R = 0.36$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.36)^{2/3}(0.074)^{1/2}$$

$$= 6.2 \text{ ft/s}$$

$$q = (6.2)(2.2) = 13.6 \text{ ft}^3/\text{s}$$

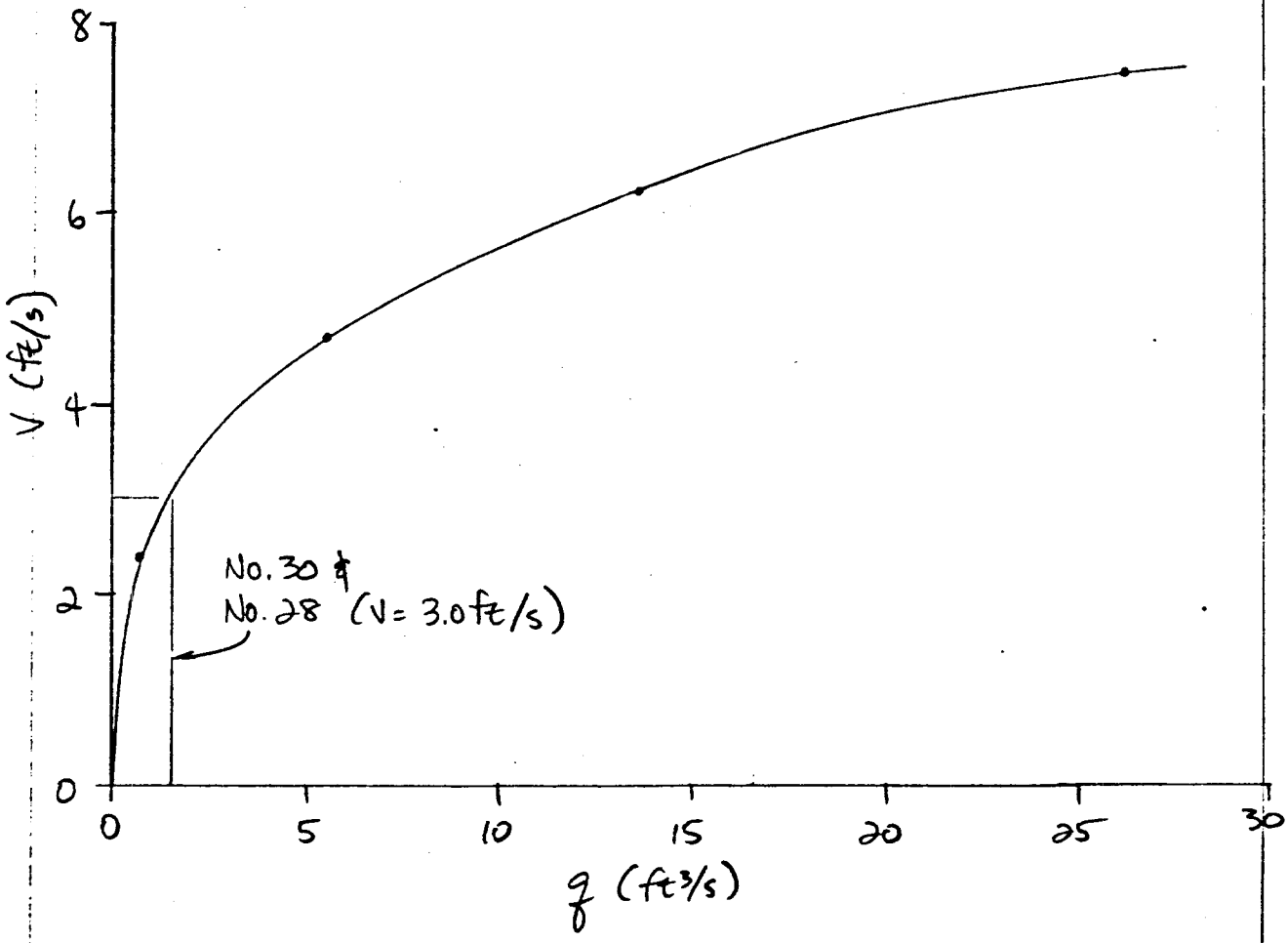
For $d = 0.7$ ft

$P = 7.3$ ft
$A = 3.5$ ft^2
$R = 0.48$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.48)^{2/3}(0.074)^{1/2}$$

$$= 7.5 \text{ ft/s}$$

$$q = (7.5)(3.5) = 26.2 \text{ ft}^3/\text{s}$$



Velocity above both culverts is below maximum permissible. Thus, spacing is adequate.

Calculations for cross section (3) (ditch between culverts 27 and 34):

$S = 0.074$ ft/ft

For $d = 0.1$ ft

$P = 3.0$ ft
$A = 0.28$ ft^2
$R = 0.09$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.09)^{2/3}(0.074)^{1/2}$$
$$= 2.4 \text{ ft/s}$$
$$q = (2.4)(0.28) = 0.67 \text{ ft}^3/\text{s}$$

For $d = 0.3$ ft

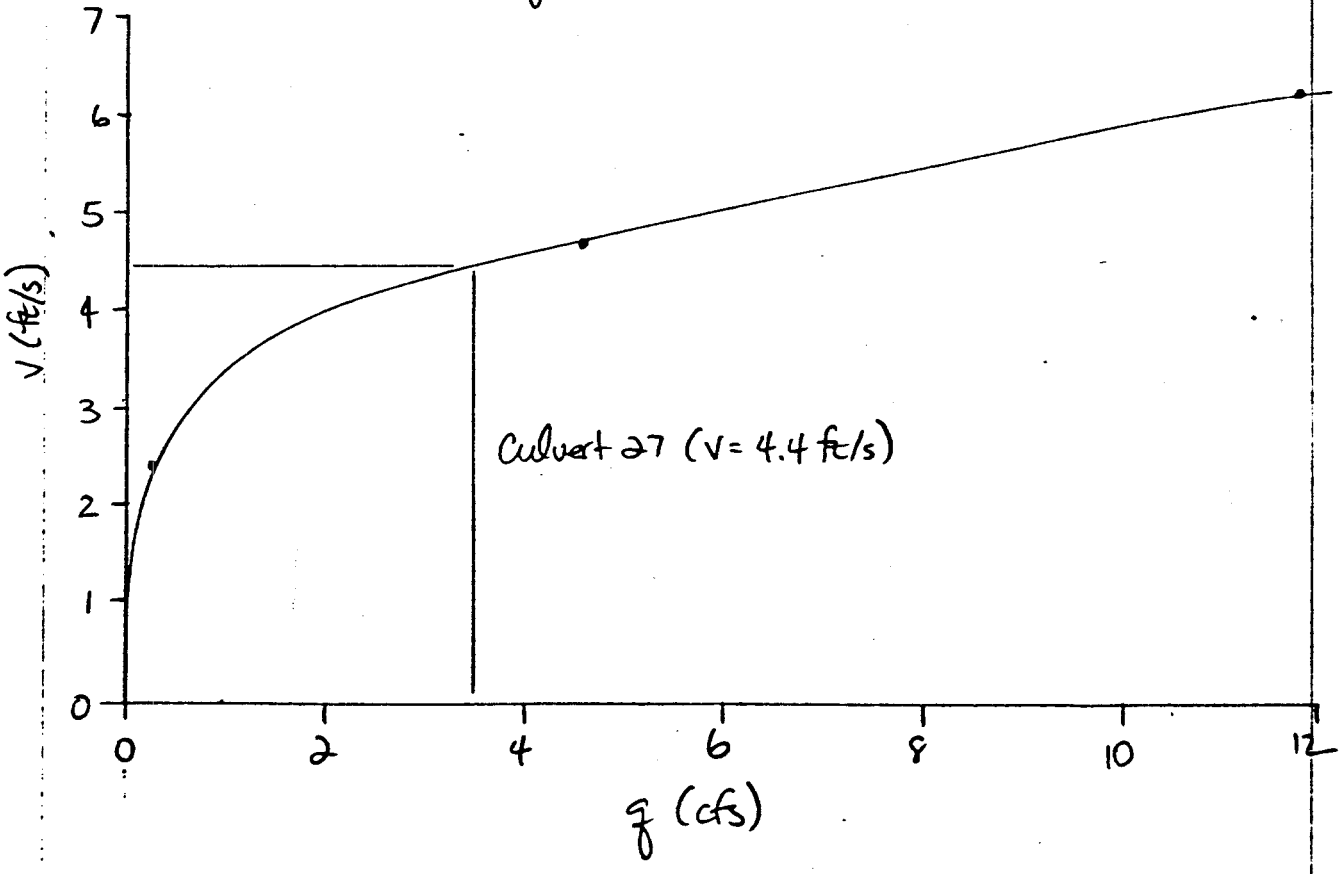
$P = 4.1$ ft
$A = 0.98$ ft^2
$R = 0.24$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.24)^{2/3}(0.074)^{1/2}$$
$$= 4.7 \text{ ft/s}$$
$$q = (4.7)(0.98) = 4.6 \text{ ft}^3/\text{s}$$

For $d = 0.5$ ft

$P = 5.2$ ft
$A = 1.9$ ft^2
$R = 0.36$ ft

$$V = \left(\frac{1.486}{0.033}\right)(0.36)^{2/3}(0.074)^{1/2}$$
$$= 6.2 \text{ ft/s}$$
$$q = (6.2)(1.9) = 11.8 \text{ ft}^3/\text{s}$$



For the area below culvert 27 and culvert 13, calculate the peak flow from the 10-yr, 24-hr storm:

See map on page 7 of these calcs. for drainage area.

$A = 29.5 \text{ ac} = 0.046 \text{ mi}^2$

$CN = 75$

$l = 3200 \text{ ft}$

$Y = \frac{(2600 \text{ ft})(160 \text{ ft})}{(29.5 \text{ ac})(43{,}560 \text{ ft}^2/\text{ac})} = 0.324 \Rightarrow 32.4\%$

$L = \frac{(l^{0.8})(s+1)^{0.7}}{1900 Y^{0.5}}$ $\qquad s = \frac{1000}{CN} - 10 = 3.33$

$= \frac{(3200)^{0.8}(4.33)^{0.7}}{(1900)(32.4)^{0.5}} = 0.16 \text{ hr}$

$T_p = 1.17 L = 0.19 \text{ hr}$

Hydrograph Family No. $\longrightarrow$ 4 (see chart on page 8)

$P = 2.25 \text{ in}$

$Q = 0.51 \text{ in}$ (see calc. on page 6)

$T_o = 12.5 \text{ hr}$ (see page 6)

Computed $T_o/T_p = 65.8$ (Use $T_o/T_p = 50$)

Revised $T_p = (12.5/50) = 0.25 \text{ hr}$

Dimensionless $q = \frac{484 AQ}{(T_p)_{rev}} = 45.4$

Max. rate factor = 0.0464 (see page 11)

$q = (45.4)(0.0464) = 2.1 \text{ ft}^3/\text{s}$

At this discharge rate, the flow velocity is 4.0 ft/s (see curve on pg. 13 of this calc.). This is less than the maximum permissible velocity for erosion protection. Hence, no additional culverts are required.

see methodology in PAP, chapter VII; section 7.5, III-2

For the area between culvert 13 and culvert 34, calculate the peak flow to the roadside ditch from the 10-yr, 24-hr storm:

$A = 7.9 \text{ ac} = 0.012 \text{ mi}^2$ (see map on page 16 of this calc.)

$CN = 75$

$l = 800 \text{ ft}$

$$Y = \frac{(4400 \text{ ft})(20 \text{ ft})}{(7.9 \text{ ac})(43{,}560 \text{ ft}^2/\text{ac})} = 0.256 \Rightarrow 25.6\%$$

$$L = \frac{(800)^{0.8}(4.33)^{0.7}}{(1900)(25.6)^{0.5}} = 0.06 \text{ hr}$$

$T_p = 1.17L = 0.07 \text{ hr}$

Hydrograph Family No. 4

$P = 2.25 \text{ in}$

$Q = 0.51 \text{ in}$ (see calc on page 6)

$T_o = 12.5 \text{ hr}$ (see page 6)

Computed $T_o/T_p = (12.5/0.07) = 178.6$ (Use $T_o/T_p = 50$)

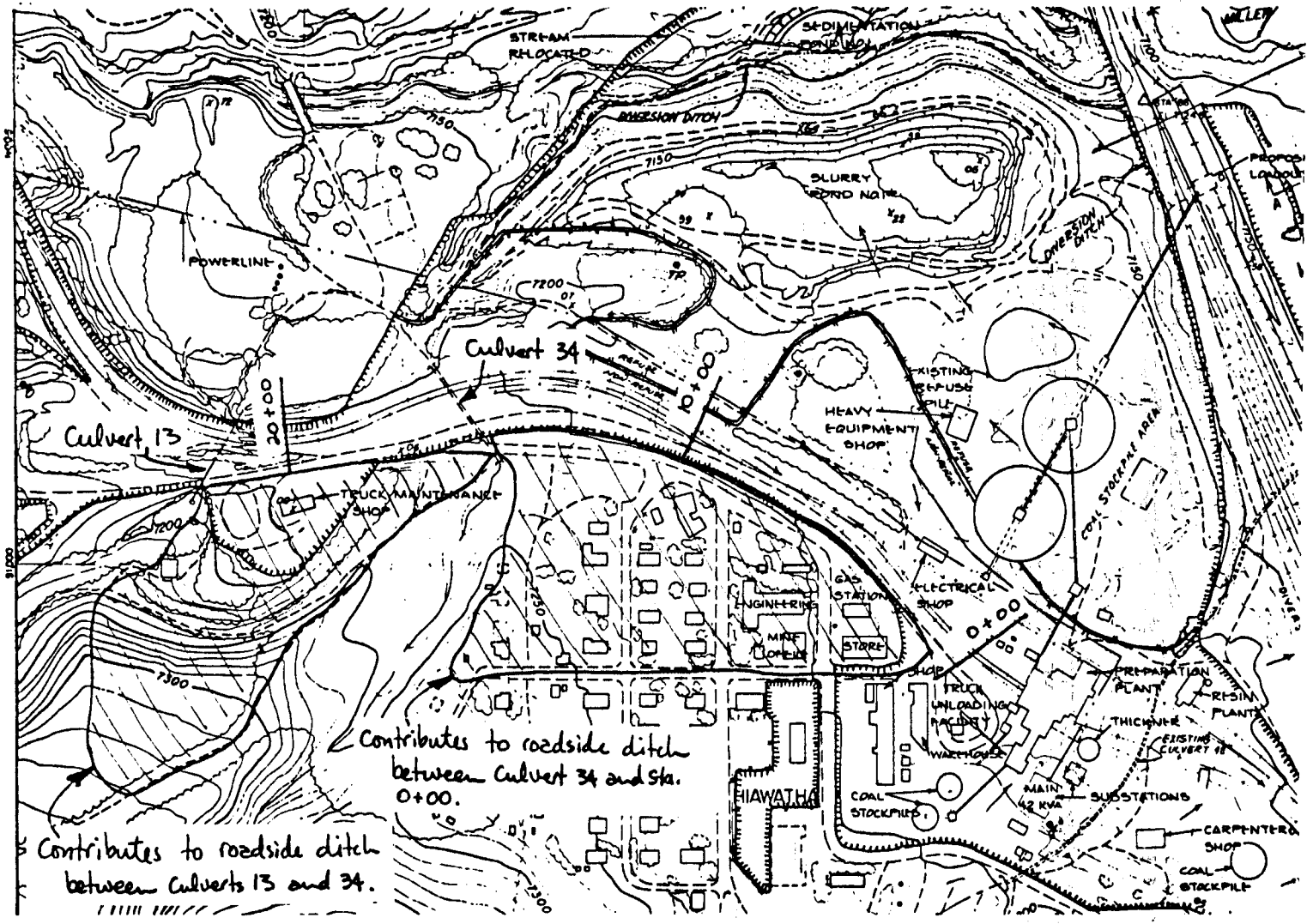
Revised $T_p = (12.5/50) = 0.25 \text{ hr}$

Dimensionless $q = \dfrac{484AQ}{(T_p)_{rev}} = 11.8$

Max. rate factor = 0.0464 (see page 11)

$q = (11.8)(0.0464) = 0.55 \text{ ft}^3/\text{s}$

At this discharge rate, the flow velocity is 2.7 ft/s (see curve on page 13 of this calc.). This is less than the maximum permissible velocity. Hence, no additional culverts are required.



From Exhibit III-3 (reduced)
Scale: 1" = 400'

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For the area from culvert 34 to station 0+00, calculate the peak flow to the roadside ditch from the 10-yr, 24-hr storm:

$A = 10.1\ ac = 0.016\ mi^2$ (see page 16 of this calc.)

$CN = 85 \Rightarrow S = 1.76$

$\ell = 1300\ ft$

$$Y = \frac{(2480\ ft)(20\ ft)}{(10.1\ ac)(43{,}560\ ft^2/ac)} = 0.113 \Rightarrow 11.3\%$$

$$L = \frac{(1300)^{0.8}(2.76)^{0.7}}{(1900)(11.3)^{0.5}} = 0.10\ hr$$

$T_p = 1.17\ L = 0.12\ hr$

Hydrograph Family No. 4

$P = 2.25\ in$

$Q = 0.51\ in$

$T_0 = 12.5\ in$

} see page 6 of this calc.

Computed $T_0/T_p = (12.5/0.12) = 104.2$ (Use $T_0/T_p = 50$)

Revised $T_p = (12.5/50) = 0.25\ hr$

Dimensionless $q = \frac{484\ A\ Q}{(T_p)_{rev}} = 15.8$

Max. rate factor = 0.0464 (see page 11)

$q = (15.8)(0.0464) = 0.73\ ft^3/s$

Flow velocity = 3.0 ft/s < Max. perm. velocity
↳ see page 13

No additional culverts required.

References:

Kent, K.M. 1973. A Method for Estimating Volume and Rate of Runoff in Small Watersheds. U.S. Soil Conservation Service Technical Publication SCS-TP-149. U.S. Government Printing Office. Washington, D.C.

U.S. Environmental Protection Agency. 1976. Erosion and Sediment Control: Surface Mining in the Eastern U.S. EPA-625/3-76-006. Resource Extraction and Handling Division, Industrial Environmental Research Laboratory. Cincinnati, Ohio.

U.S. Soil Conservation Service. 1986. National Engineering Handbook: Section 5 - Hydraulics. U.S. Government Printing Office. Washington, D.C.

U.S. Soil Conservation Service. 1972. National Engineering Handbook: Section 4 - Hydrology. U.S. Government Printing Office. Washington, D.C.

APPENDIX B

Calculation of Exit Velocities From Culverts

VELOCITY CALCULATIONS FOR EXISTING CULVERTS W/ RIGID DOWNSPOUTS

Discharge from the 10-yr, 24-hr storm:

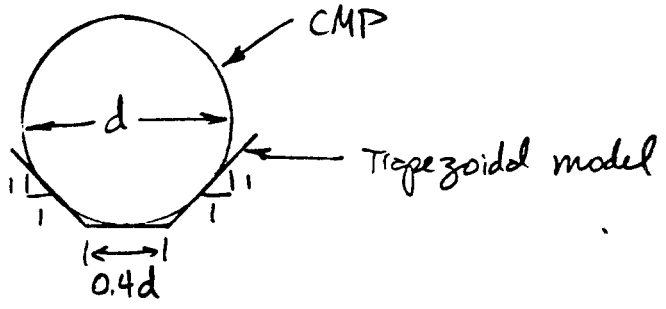
Data from PAP, Chapter VII ; Section 7.5 , III-1

Culvert	Peak Flow (cfs)	
28	1.6	No downspouts required on culverts 13, 27, and 29
30	1.6*	
31	2.3	
32	1.4	
33	7.1	
34	31.1	

* Revised in culvert spacing calc.

Velocity Calculations

Simplify the culvert geometry to a trapezoidal channel:



Bottom width = 0.4 d
Side slopes = 1:1
} Use TRAP1 developed by OSM and discussed by Weidel et al. (1983)

n = 0.024 (typical of CMP culvert — see AISI, 1983)

Slope = 100% (45° bend at existing outlet to enter downspout)

Culvert No.	Diameter (ft)	0.4 d (ft)	Flow Depth (ft)	Flow Velocity (ft/s)
28	3	1.2	0.10	12.2
30	2	0.8	0.13	13.5
31	2	0.8	0.16	15.2
32	2	0.8	0.11	12.9
33*	3	1.2	0.29	16.3

* Downspout will be extended to Middle Fork stream channel. Slope on extension will be 1h : 0.53 v (from profile below existing outlet).

All flow depths in the above table are significantly less than 0.5 d. Hence, the model is considered valid.

Culvert 34 begins as a 48-in CMP and was extended apparently during RR construction. Existing outlet is 12-in steel pipe. This will be replaced with a steel plate at the end of the 48-in CMP and an extended CMP to the main stream channel. Assume the extension is a 24-in CMP:

$0.4\,d = 0.8$

slope = 1h : 0.2 v (downspout extended to main channel)

Flow depth = 1.0 ft
Velocity = 17.4 ft/s

} Flow depth = 0.5 d. Hence, velocity will be slightly less than calculated.

High exit velocities will require energy dissipation at outlets.

Check design of splash basins:

Use methodology developed by Corry et al. (1975)

Equivalent depth = $Y_e = (A/2)^{1/2}$

where A = flow area in culvert = CD^2

C = coefficient (fraction) ⇒ see page 4 of this calc.

D = diameter (ft)

d_{50} for splash basin should be selected such that

$$0.25 < d_{50}/Y_e < 0.45$$

or

$$0.25 Y_e < d_{50} < 0.45 Y_e$$

Thus, the maximum d_{50} required is $0.45 Y_e$. Determine maximum d_{50} as given below:

Culvert No.	Flow Depth (ft)	Flow Area (ft^2)	Y_e (ft)	Maximum d_{50} (in)
28	0.10	0.09	0.21	1.1
30	0.13	0.08	0.20	1.1
31	0.16	0.12	0.24	1.3
32	0.11	0.06	0.17	0.9
33	0.29	0.36	0.42	2.3
34	1.00	1.56	0.88	4.8

} Doubtful that this size will be stable. See below.

Determine stable riprap size using the Isbach eq.:

$$W = (2.44 \times 10^{-5}) V^6$$

where W = d_{65} stone weight (lb)

V = velocity (ft/s)

$$d_{65} = \left[\frac{6 W_{65}}{\pi \gamma_{65}}\right]^{\frac{1}{3}}$$

d_{65} = ft

γ_{65} = stone weight = 165 lb/ft³

} see U.S. Army Corps. of Engineers (1970)

Table 7.9. Area of Flow
$A = C D^2$, d = depth of flow and D = pipe diameter.

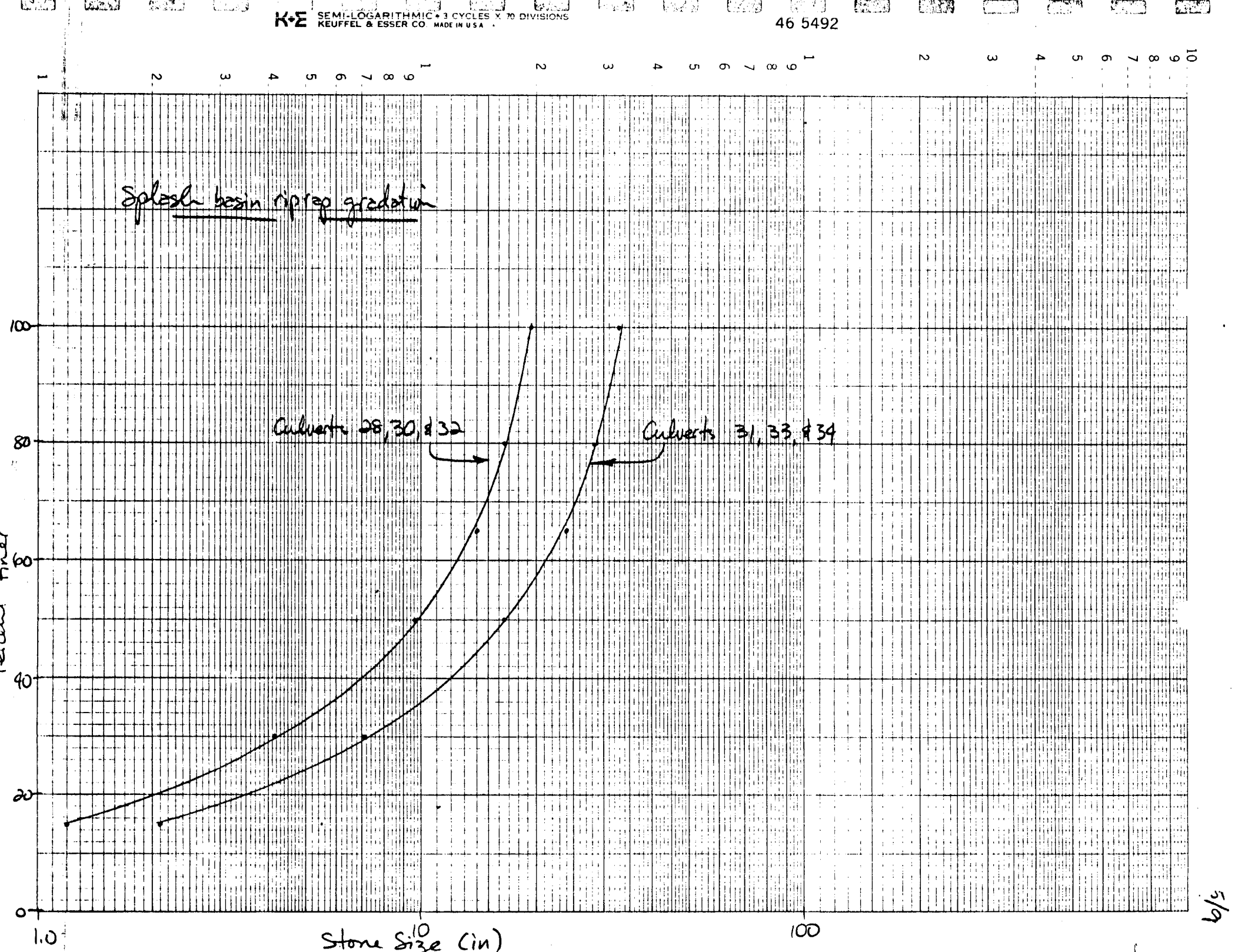
$\frac{d}{D}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.00	.00	.00	.01	.01	.01	.02	.02	.03	.04
.1	.04	.05	.05	.06	.07	.07	.08	.09	.10	.10
.2	.11	.12	.13	.14	.14	.15	.16	.17	.18	.19
.3	.20	.21	.22	.23	.24	.24	.25	.26	.27	.28
.4	.29	.30	.31	.32	.33	.34	.35	.36	.37	.38
.5	.39	.40	.41	.42	.43	.44	.45	.46	.47	.48
.6	.49	.50	.51	.52	.53	.54	.55	.56	.57	.58
.7	.59	.60	.61	.61	.62	.63	.64	.65	.66	.67
.8	.67	.68	.68	.70	.70	.71	.72	.72	.73	.74
.9	.74	.75	.76	.76	.77	.77	.78	.78	.78	.78

Source: Barfield et al. (1981)

Using the Isbach equation, the following stable d_{65} sizes were determined:

Culvert No.	Velocity (ft/s)	W_{65} (lb)	d_{65} (in)
28	12.2	80	11.7
30	13.5	148	14.3
31	15.2	301	18.2
32	12.9	112	13.1
33	16.3	458	20.9
34	17.4	677	23.8

For simplicity of construction, use d_{65} = 24 in below culverts 31, 33, and 34. Use d_{65} = 14 in below culverts 28, 30, and 32. Distribute as shown on page 5 of this calc.



References

American Iron and Steel Institute. 1983. Handbook of steel Drainage and Highway Construction Products. AISI. Washington, D.C.

Barfield, B.J., R.C. Warner, and C.T. Haan. 1981. Applied Hydrology and Sedimentology For Disturbed Areas. Oklahoma Technical Press. Stillwater, Oklahoma.

Corry, M.L., P.L. Thompson, F.J. Watts, J.S. Jones, and D.L. Richards. 1975. Hydraulic Design of Energy Dissipators for Culverts and Channels. Hydraulic Engineering Circular No. 14 U.S. Dept. of Trans. Washington, D.C.

Heede, B.H. 1976. Gully Development and Control: The Status of Our Knowledge. USDA Forest Service Research Paper RM-169. Rocky Mtn. Forest and Range Exp. Sta. Fort Collins, Colorado.

U.S. Army Corps of Engineers. 1970. Hydraulic Design of Flood Control Channels. EM-1110-2-1601. Washington, D.C.

Weidy, M.F., K.G. Kirk, and L.E. Welborn. 1983. Simplified Analysis Routines for Surface and Groundwater Hydrology Applications in Surface Mining. Proceedings of the 1983 Symposium on Surface Mining Hydrology, Sedimentology, and Reclamation. Univ. of Kentucky. Lexington, Kentucky.

APPENDIX C

Check Dam Design Calculations

CHECK-DAM DESIGN
MIDDLE FORK ROAD

Design criteria:

Heede, B.H. 1976. Gully Development and Control: The Status of Our Knowledge. USDA Forest Service Research Paper RM-169. Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado.

Channel longitudinal profiles:

See the following pages of this calculation:

Pg 2 → Below Culvert 33
Pg. 3 → Below Culvert 32
Pg. 4 → Below Culvert 31
Pg. 5 → Below Culvert 30
Pg. 6 → Below Culvert 28

Typical check-dam design:

See page 7 of this calculation

Check dam spacing:

Space dams to be located near the upstream toe of the final sediment deposits of the next dam downstream. Determine spacing according to the equation (Heede, 1976):

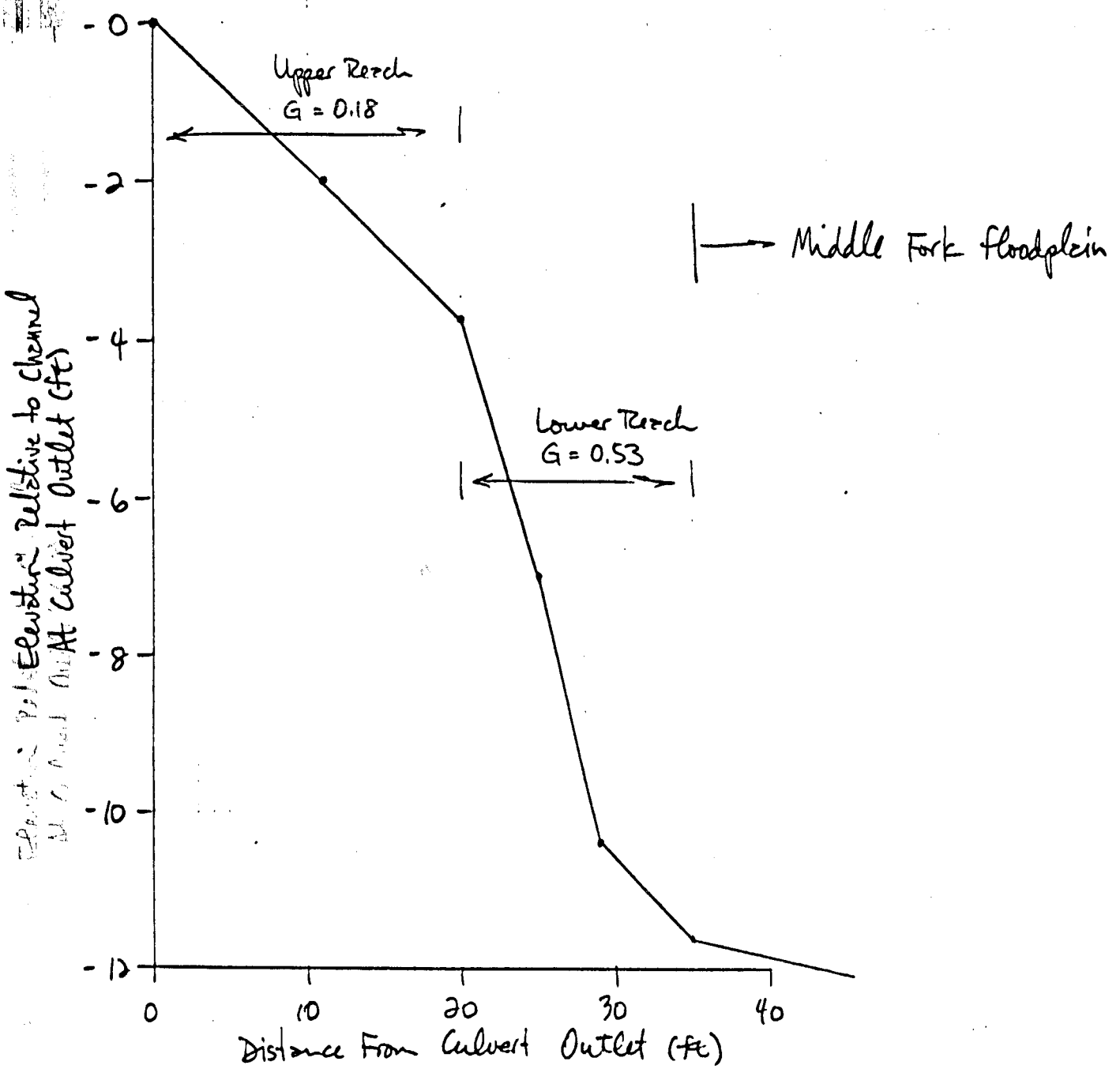
$$S = \frac{H_e}{KG\cos\alpha}$$

where S = spacing (ft)
H_e = effective dam height (ft)
K = slope factor $\begin{cases} = 0.3 \text{ for } G \leq 0.20 \\ = 0.5 \text{ for } G > 0.20 \end{cases}$

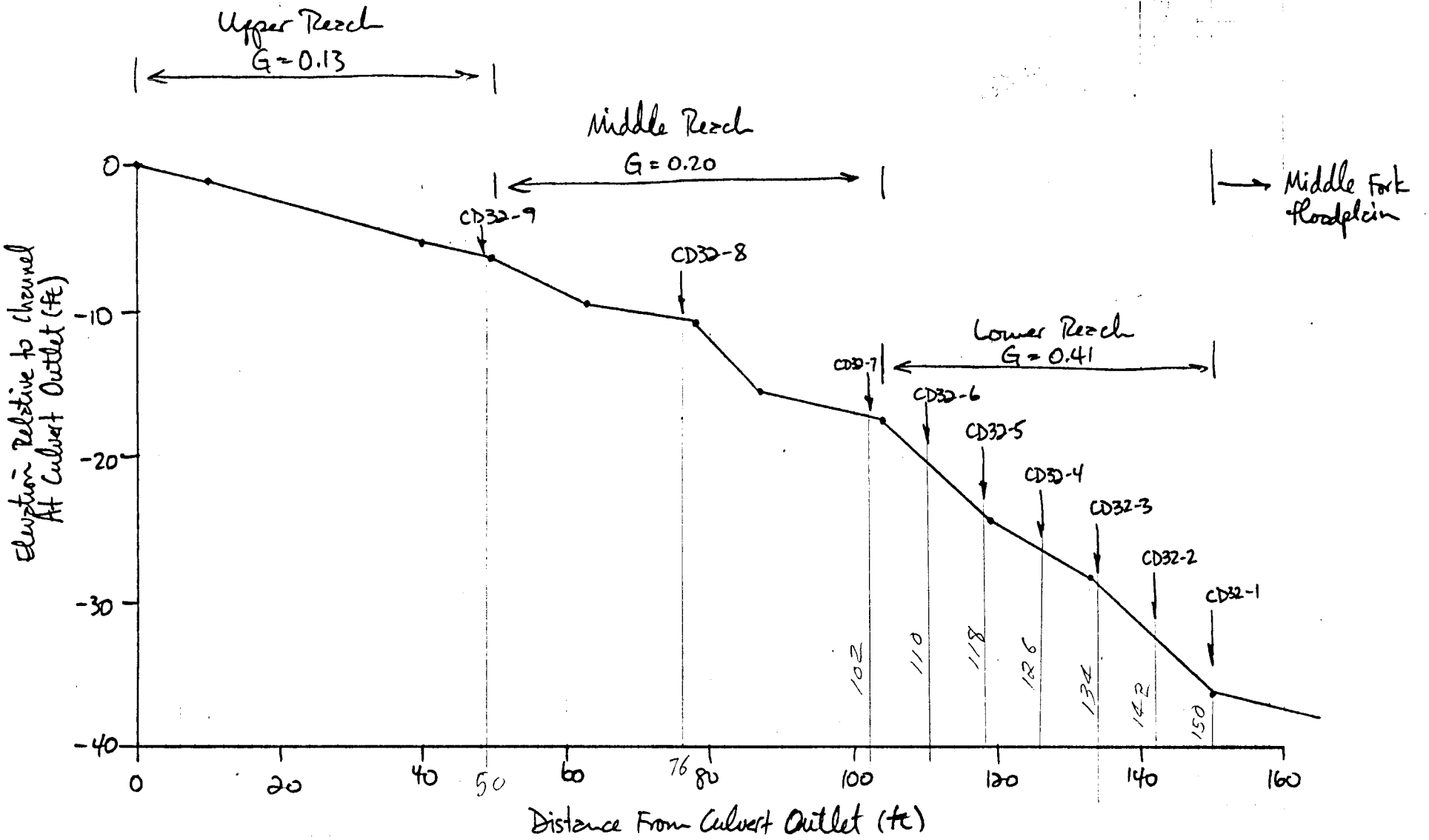
G = gully gradient (fraction)
α = gully gradient (degrees)

Note: $G = \tan\alpha$

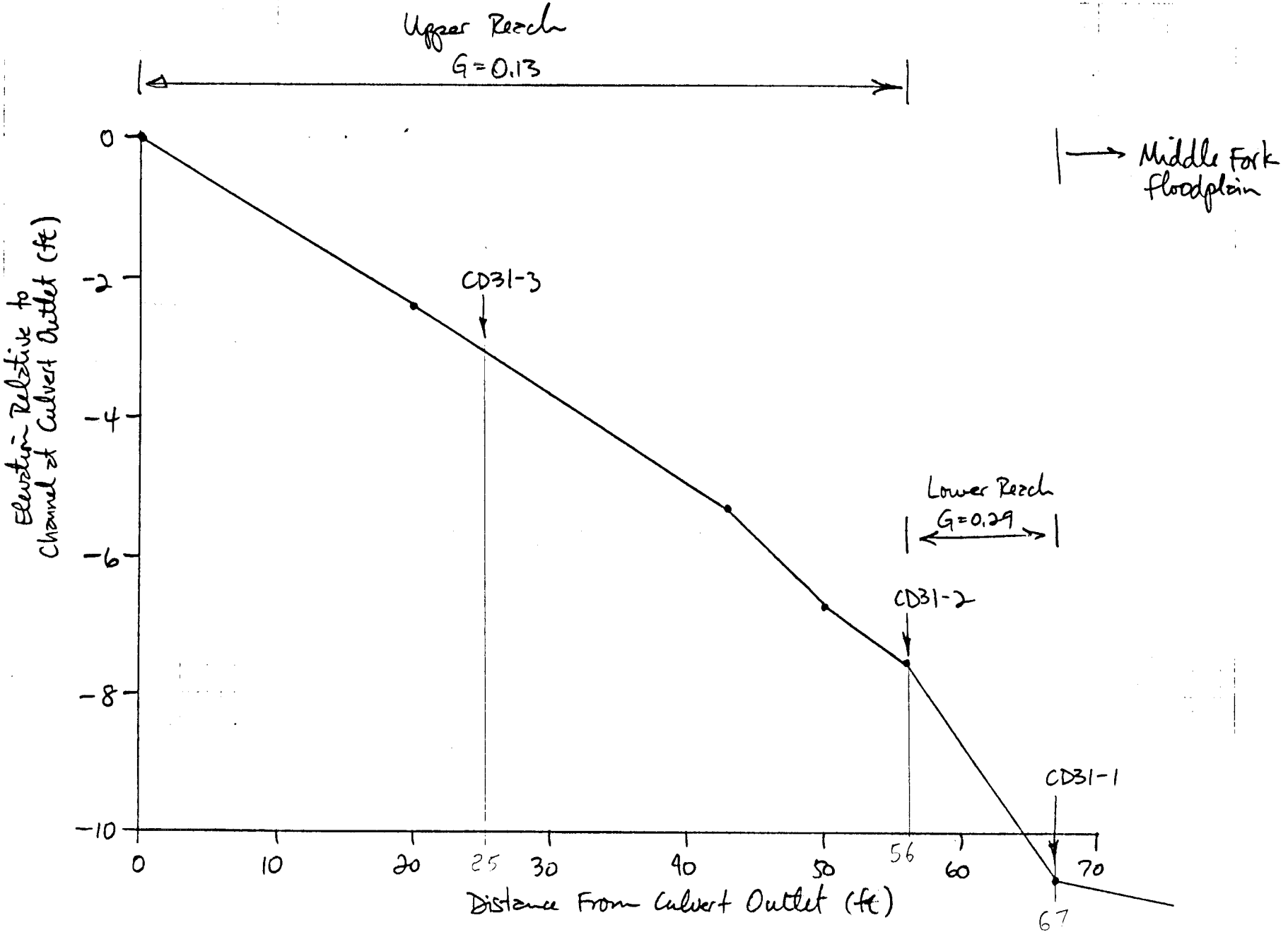
Longitudinal profile below culvert 33



Longitudinal profile for channel below culvert 32

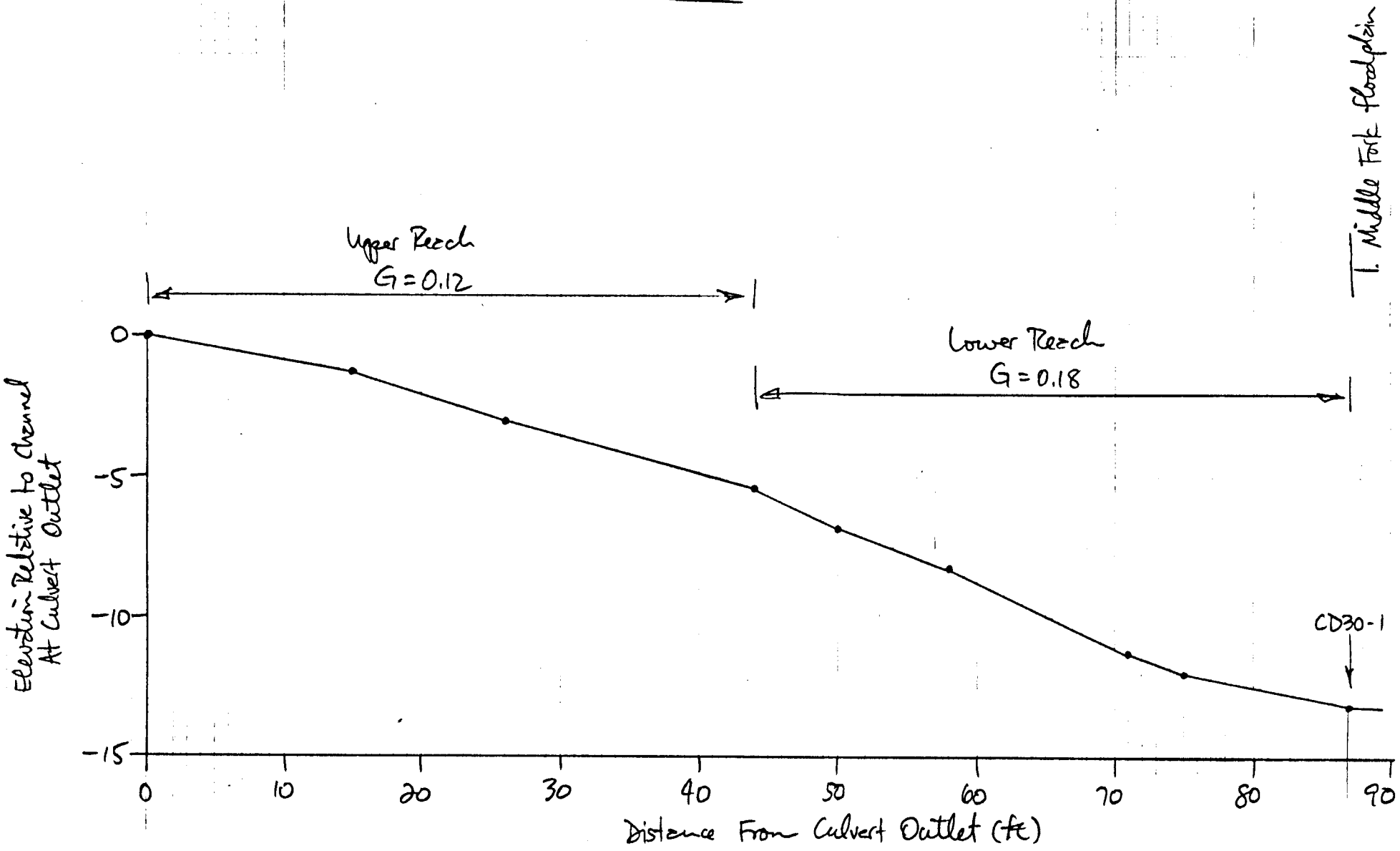


Longitudinal profile for channel below culvert 31



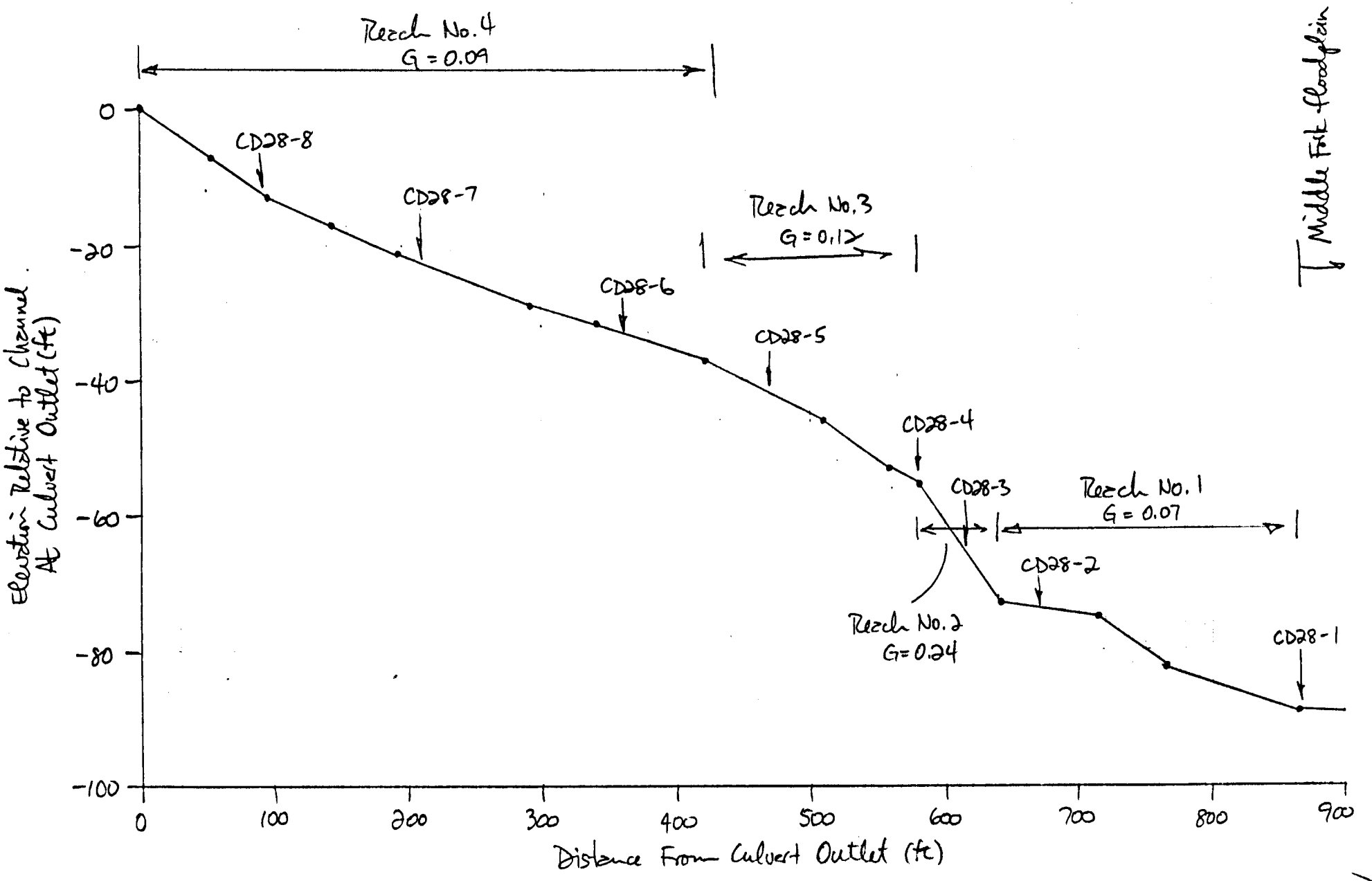
31/4

Longitudinal profile for channel below culvert 30



8/5

Longitudinal profile for channel below culvert 28



8/9

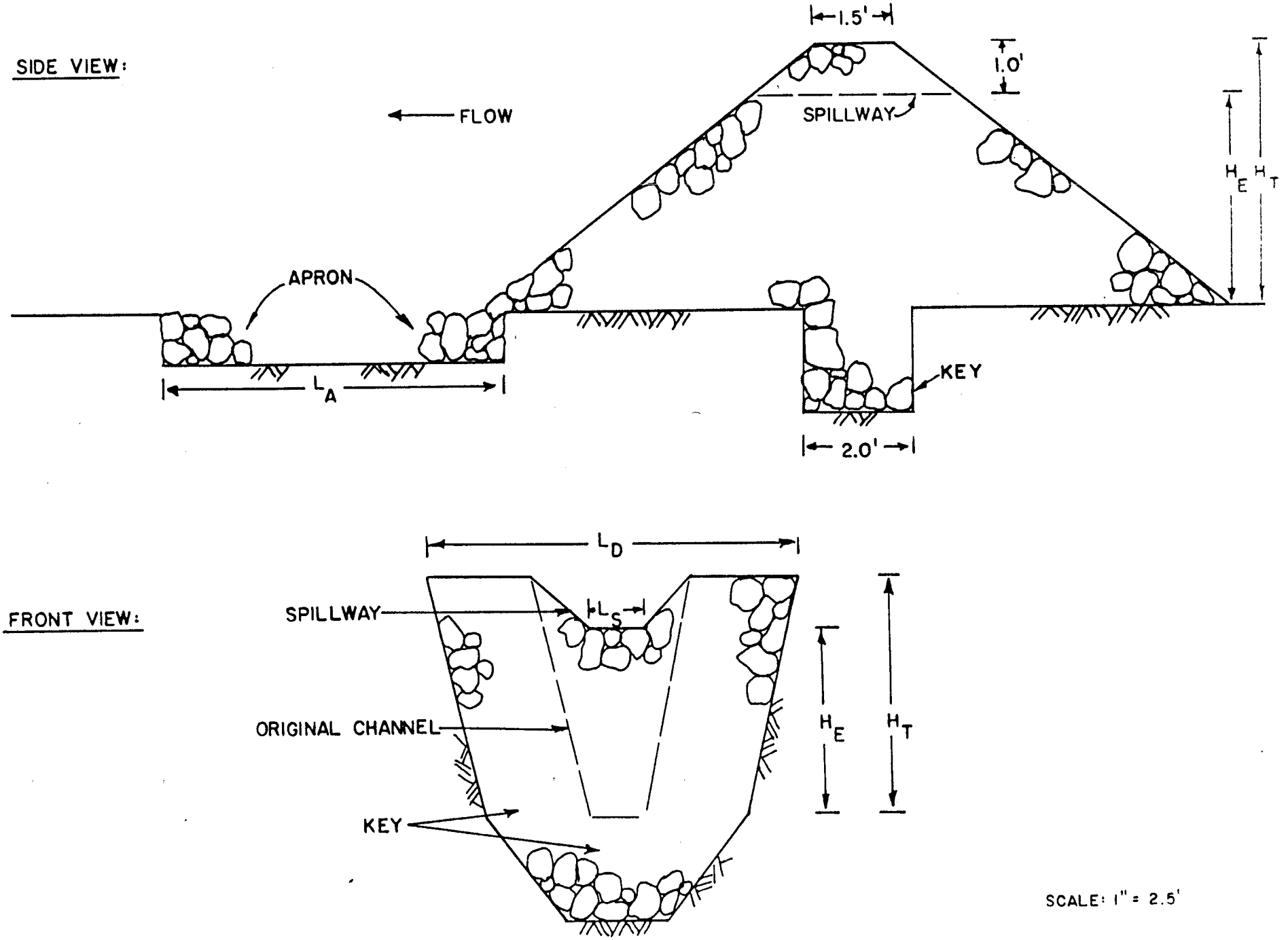


Figure 1. Typical Loose-Rock Check Dam.

Effective dam heights:

Culvert	H_e (ft)	
33	1.5	Based on channel geometry
32	1.5	
31	1.5	
30	6.0	
28	4.0	

Culvert 33:

Lower reach → $G = 0.53$, $K = 0.5$, $\alpha = 27.7°$ } $S = 6.1$ ft

Requires 3 CD's as noted on page 2

Upper reach → $G = 0.18$, $K = 0.3$, $\alpha = 10.2°$ } $S = 28.4$ ft

Location of CD33-3 adequate for upper reach

Culvert 32:

Lower reach → $G = 0.41$, $K = 0.5$, $\alpha = 22.3°$ } $S = 7.9$ ft

Requires 7 CD's as shown on page 3

Middle reach → $G = 0.20$, $K = 0.3$, $\alpha = 11.2°$ } $S = 25.5$ ft

Requires 2 CD's as shown on page 3

Upper reach → $G = 0.13$, $K = 0.3$, $\alpha = 7.4°$ } $S = 38.8$ ft

Location of CD32-9 adequate for upper reach

Culvert 31:

Lower reach → G = 0.29, K = 0.5, α = 16.2° } S = 10.8 ft

Requires 2 CD's as shown on page 4

Upper reach → G = 0.13, K = 0.03, α = 7.6° } S = 38.8 ft

Requires 1 CD as shown on page 4

Culvert 30:

Lower reach → G = 0.18, K = 0.3, α = 10.2° } S = 112.9 ft

Requires 1 CD at end as shown on page 5

Culvert 28:

Reach No. 1 → G = 0.07, K = 0.3, α = 4.2° } S = 191.0 ft

Requires 2 CD's as shown on page 6

Reach No. 2 → G = 0.24, K = 0.5, α = 13.5° } S = 34.3 ft

Requires 2 CD's as shown on page 6

Reach No. 3 → G = 0.12, K = 0.3, α = 7.1° } S = 112.0 ft

Requires 2 CD's as shown on page 6

Reach No. 4 → G = 0.09, K = 0.3, α = 5.0° } S = 148.7 ft

Requires 2 CD's as shown on page 6

Volumes required for check dams:

$$V_T = V_{LR} + V_K + V_A$$

where V_T = total rock volume

V_{LR} = volume of dam proper

$$= \frac{H_T^2}{\tan A_R} + 0.6 H_T L_A - V_{SP}$$

H_T = total dam height

A_R = angle of repose of the rock

L_A = avg. length of the dam

$$= L_B + \frac{L_u - L_B}{2D} H_T$$

L_B = dam length at bottom

L_u = dam length at freeboard top

D = gully depth

V_{SP} = volume of the spillway

$$= H_S L_{AS} B_A$$

H_S = depth of spillway

L_{AS} = effective length of the spillway

$$B_A = \frac{H_S}{0.70711 \tan A_R} + 0.3$$

V_K = volume of the key

$$= (L_A + 2R)(0.6 H_T + 0.36) - 0.6 H_T L_A$$

R = key depth

V_A = volume of the apron

$$= c H_T L_B + d H_T^2$$

for $G \leq 0.15$: $c = 1.5$, $d = 3.0$

for $G > 0.15$: $c = 1.75$, $d = 3.5$

CD33, CD32, and CD31 series:

$A_R = 1.25 : 1.00 = 38.7°$

$H_T = 2.5$ ft
$L_B = 2.0$ ft
$L_u = 8.0$ ft
$D = 2.0$ ft
} $L_A = 5.8$

$H_s = 1.0$
$L_s = 2.0$
$B_A = \dfrac{1.0}{(0.70711)(\tan 38.7°)} + 0.3 = 2.1$ ft
} $V_{sp} = 4.2$

$$V_{LR} = \frac{(2.5)^2}{(\tan 38.7°)} + (0.6)(2.5)(5.8) - 4.2 = \underline{12.3 \text{ ft}^3}$$

$R = 2.0$ ft

$$V_k = [5.8 + (2)(2.0)][(0.6)(2.5) + 0.36] - (0.6)(2.5)(5.8)$$
$$= \underline{9.5 \text{ ft}^3}$$

G ⟹ generally > 0.15 for channels below culverts 31-33

$$V_A = (1.5)(2.5)(2.0) + (3.0)(2.5)^2$$
$$= \underline{26.2 \text{ ft}^3}$$

$V_T = 12.3 + 9.5 + 26.2 = 48 \text{ ft}^3$

$V_T = 1.8 \text{ yd}^3/\text{CD}$ ⟹ Use $V_T = 2.0 \text{ yd}^3/\text{CD}$

Total volumes ⟶ No. 33 : (3 CD's)(2.0 yd³/CD) = 6.0 yd³
No. 32 : (9 CD's)(2.0 yd³/CD) = 18.0 yd³
No. 31 : (3 CD's)(2.0 yd³/CD) = 6.0 yd³

CD30 series:

$A_R = 38.7°$

$H_T = 6.0$ ft

$L_B = 3.0$ ft

$L_u = 9.0$ ft

$D = 6.0$ ft

$L_A = 6.0$

$H_s = 1.0$

$L_s = 3.0$

$B_A = \frac{1.0}{(0.70711)(\tan 38.7°)} + 0.3 = 2.1$

$V_{sp} = 6.3$

$$V_{LR} = \frac{(6.0)^2}{\tan 38.7°} + (0.6)(6.0)(6.0) - 6.3 = \underline{60.2 \text{ ft}^3}$$

$R = 2.0$ ft

$$V_K = [(6.0) + (2)(2.0)][(0.6)(6.0) + 0.36] - (0.6)(6.0)(6.0)$$

$$= \underline{48.0 \text{ ft}^3}$$

G $\Rightarrow$ averages about 0.15 $\longrightarrow$ $c = 1.5$, $d = 3.0$

$$V_A = (1.5)(6.0)(3.0) + (3.0)(6.0)^2$$

$$= \underline{135 \text{ ft}^3}$$

$V_T = 60 + 48 + 135 = 243 \text{ ft}^3/\text{CD}$

$= 9 \text{ yd}^3/\text{CD} \Rightarrow$ use $V_T = 10.0 \text{ yd}^3/\text{CD}$

1 CD required $\longrightarrow$ Total volume = 10.0 yd^3

CD28 series:

$A_R = 38.7°$

$H_T = 5.0$ ft
$L_B = 1.0$ ft
$L_u = 7.0$ ft
$D = 4.0$ ft
} $L_A = 4.8$

$H_s = 1.0$
$L_s = 1.0$

$$B_A = \frac{1.0}{(0.70711)(\tan 38.7°)} + 0.3 = 2.1$$

} $V_{sp} = 2.1$

$$V_{LR} = \frac{(5.0)^2}{\tan 38.7°} + (0.6)(5.0)(4.8) - 2.1 = \underline{43.5 \text{ ft}^3}$$

$R = 2.0$ ft

$$V_K = [4.8 + (2)(2.0)][(0.6)(5.0) + 0.36] - (0.6)(5.0)(4.8)$$

$$= \underline{15.2 \text{ ft}^3}$$

G ⟹ generally less than 0.15 : $c = 1.5$, $d = 3.0$

$$V_A = (1.5)(5.0)(1.0) + (3.0)(5.0)^2 = \underline{82.5 \text{ ft}^3}$$

$V_T = 43.5 + 15.2 + 82.5 = 141.2 \text{ ft}^3$

$= 5.2 \text{ yd}^3 \Longrightarrow$ Use $V_T = 5.5 \text{ yd}^3/\text{CD}$

8 CD's required → Total volume $= (8)(5.5) = 44 \text{ yd}^3$

Cost effectiveness of check dams:

Approx. cost of check dams = $25/yd³ installed

Below culvert 33 → ($25/yd³)(6 yd³) = $150

Below culvert 32 → ($25/yd³)(18 yd³) = $450

Below culvert 31 → ($25/yd³)(6 yd³) = $150

Below culvert 30 → ($25/yd³)(10 yd³) = $250

Below culvert 28 → ($25/yd³)(44 yd³) = $1100

Cost of flexible downspout or CMP:

24" → approx. $10/ft installed

36" → approx. $15/ft installed

Culvert 33 (36") → (40 ft)($15/ft) = $600

Culvert 32 (24") → (160 ft)($10/ft) = $1600

Culvert 31 (24") → (70 ft)($10/ft) = $700

Culvert 30 (24") → (90 ft)($10/ft) = $900

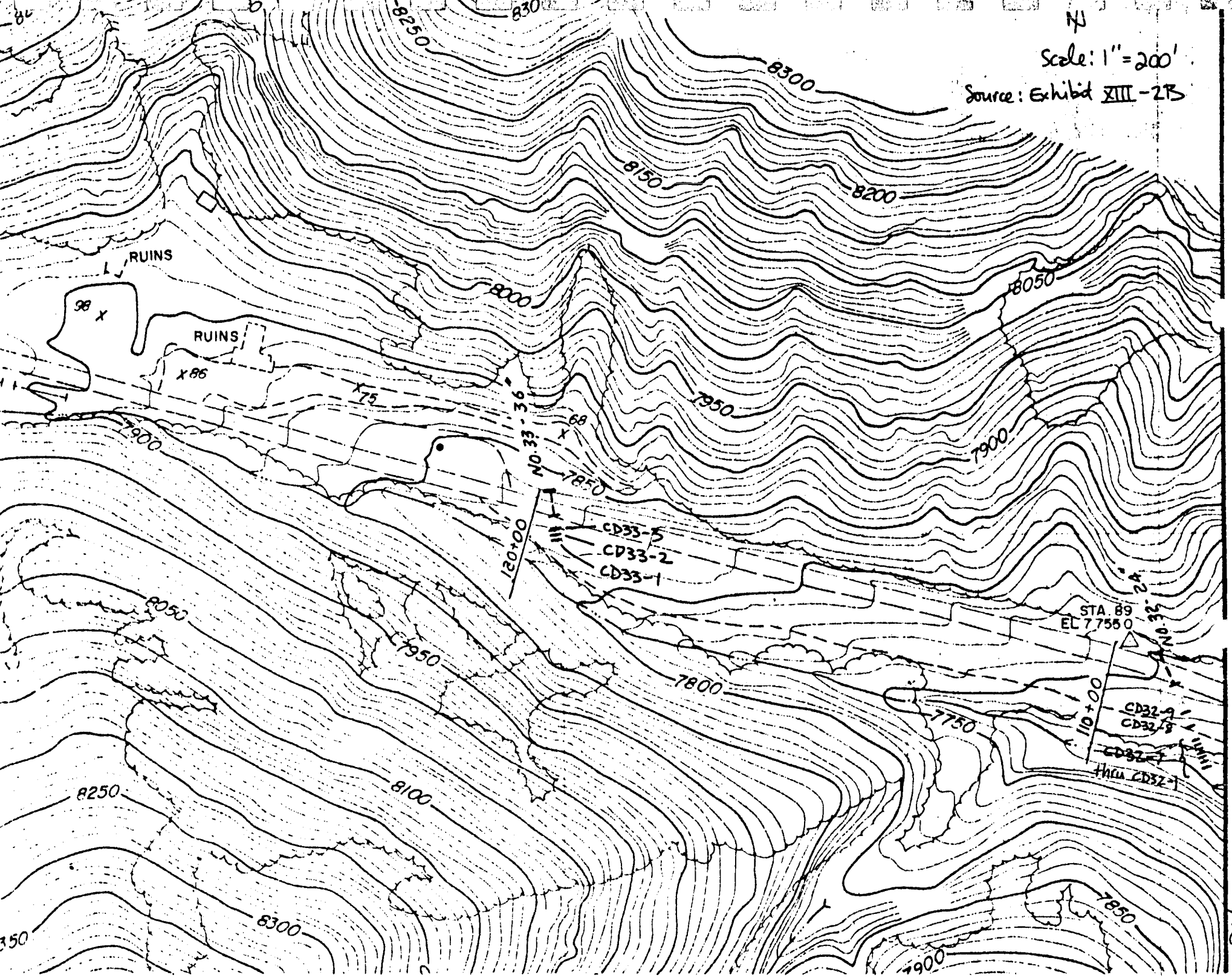
Culvert 28 (36") → (200 ft)($15/ft) = $3000

→ straight to Middle Fork (not following existing channel)

Check dams cheaper in all cases. Therefore, use check dams as designed.

Check dam locations:

See maps on pages 15, 16, and 17 of this calc. Drainage areas contributing to each CD are as identified for the culverts on Exhibit XIII-2A of the PAP (partially reproduced herein as page 18 of this calc.).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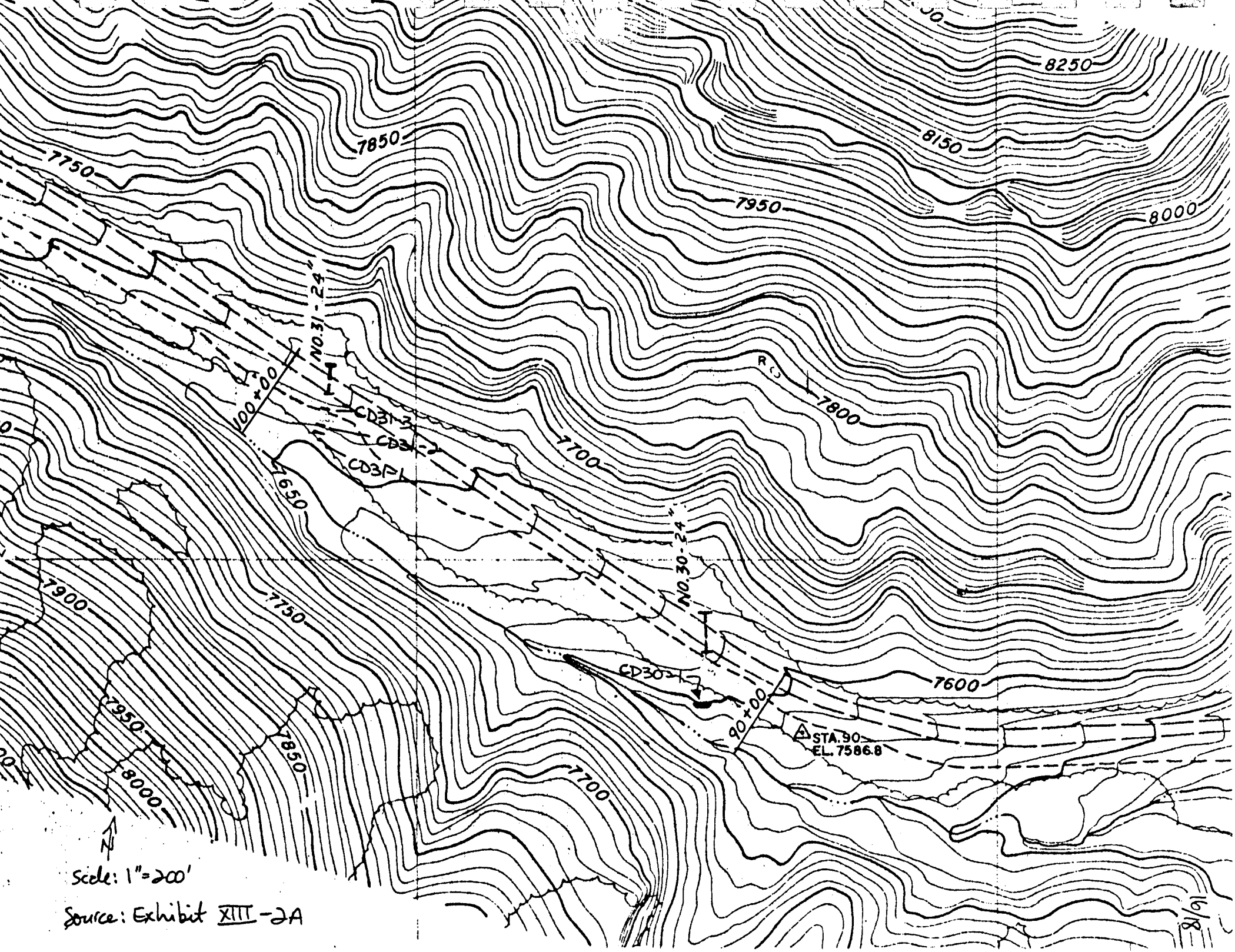
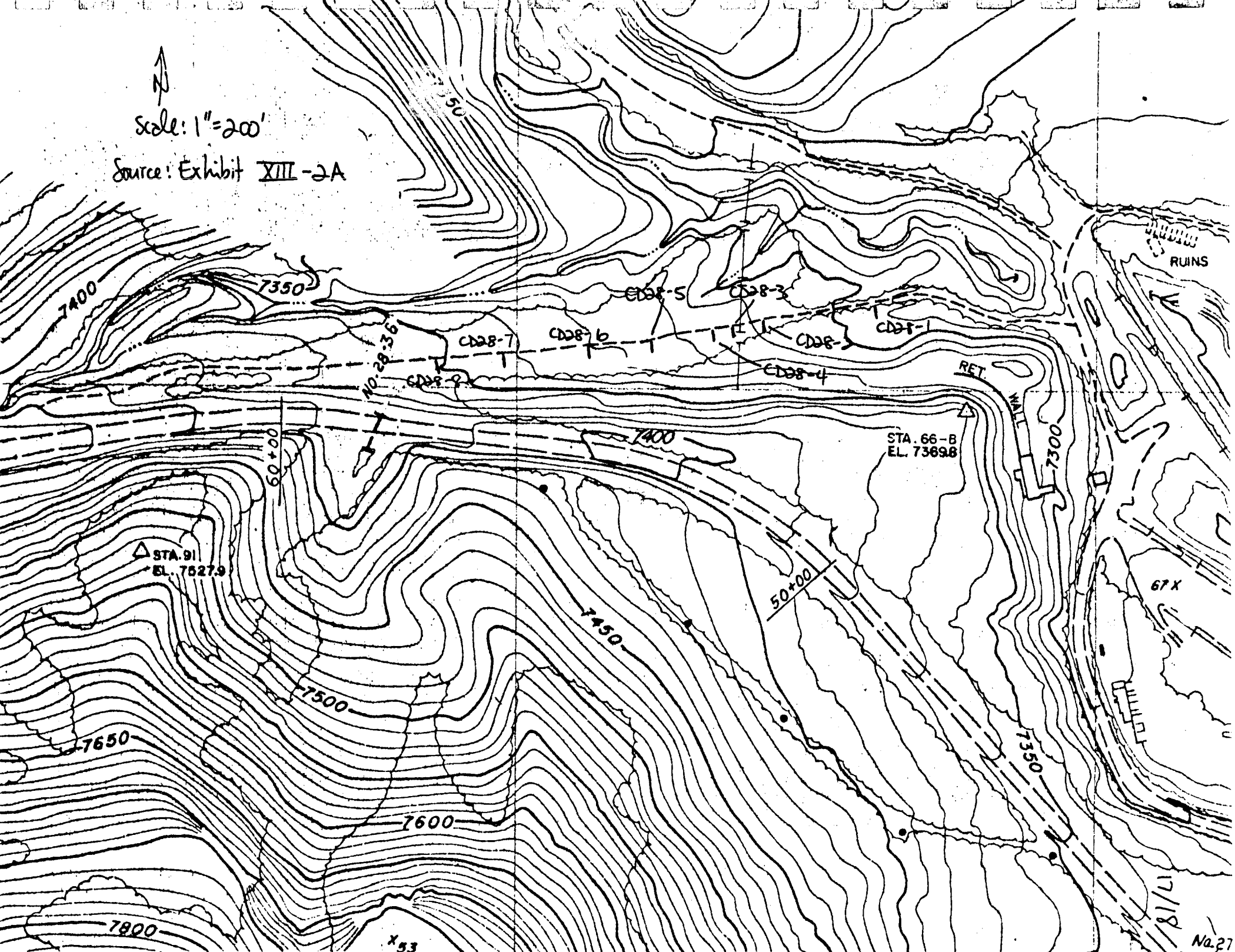
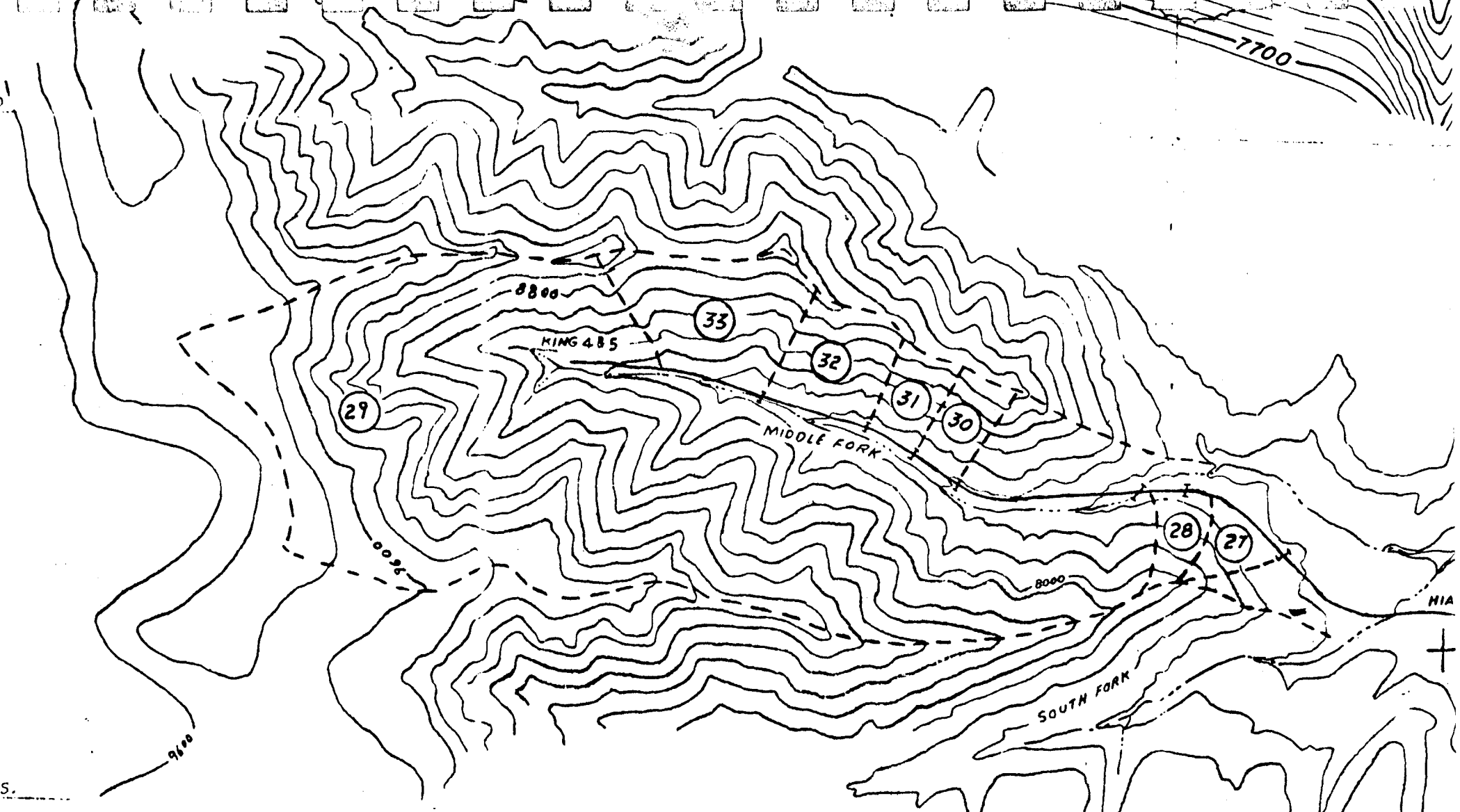
Scale: 1" = 200'
Source: Exhibit XIII-2B
8300
8250
8200
8150
8100
8050
8000
7950
7900
7850
7800
7750
8300
8250
RUINS
RUINS
98
86
75
68
NO. 33-36
120+00
CD33-3
CD33-2
CD33-1
STA. 89
EL 7755.0
110+00
CD32-9
CD32-8
thru CD32-1
24-32
15/18


8250
8150
7850
7750
7950
8000
7800
7700
7650
7900
7750
7950
8000
7850
7700
7600
NO. 31 - 24"
NO. 30 - 24"
100+00
90+00
CD31-3
CD31-2
CD31-1
CD30-1
STA. 90
EL. 7586.8
N
Scale: 1"=200'
Source: Exhibit XIII-2A


Scale: 1"=200'
Source: Exhibit XIII-2A
RUINS
CD28-5
CD28-3
CD28-1
CD28-2
CD28-6
CD28-7
CD28-8
CD28-4
NO. 28-36
RET. WALL
STA. 66-B
EL. 7369.8
STA. 91
EL. 7527.9
60+00
50+00
7400
7350
7450
7500
7550
7600
7650
7700
7800
7300
67X



MIDDLE FORK WATERSHED AREAS

SCALE 1" = 2,000'

CONTOUR INTERVAL 160'

(27) WATERSHEDS RELATING TO GIVEN CULVERTS

SEE TABLE XIII-2 FOR RUNOFF CALCULATIONS

81/81

APPENDIX III-16

MOHRLAND PIPELINE UPGRADE

May 24, 1988

UNITED STATES FUEL COMPANY

HIAWATHA, UTAH 84527
801-637-2252
TELEX 453-123

May 24, 1988

AMENDMENT TO
APPROVED Mining & Reclamation Plan
Approved, Division of Oil, Gas & Mining
by _____ date 6/17/88

Ms. Susan Linner, Permit Supervisor
Division of Oil, Gas and Mining
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RE: Mohrland Pipeline - Proposed Upgrade

Dear Sue;

United States Fuel Company would like to present a plan for a minor amendment in order to upgrade a portion of the Mohrland pipeline, i.e., a segment between the loadout and first curve. Refer to the enclosed topographic map. The pipeline is located in T. 16S., R. 8E., Sec. 9, S 1/2 SE 1/4.

Presently, a fixed sum has been allocated toward capital improvement of the pipeline. If the entire sum is used to buy new pipe, it is anticipated that the lower 660 feet of pipe from the first curve down toward the Mohrland rail yard can be replaced. The company would like to begin work on this project as soon as possible.

The new pipeline would be laid along the old tram line. The old tram line once conveyed railcars from the mine mouth at the Mohrland portal to the loadout. The only thing which remains of the tram line is the original grade. The tram line is flat in cross-section with a berm on the downstream edge. It runs approximately parallel to the road along the lower stretch. Because of the present configuration of the tram line, very minimal disturbance would occur if the pipeline is installed along it. This location would be very desirable as it removes the pipeline from its present ditchline location. With the pipeline out of the road, the road can be maintained more effectively and the damage due to water leaks greatly reduced.

A length of steel pipe would be used to slope up from the old pipeline to the tram grade. The sloping pipe would connect to a 10" steel pipeline laid along the tram line grade. Twenty foot lengths of 10" pipe will be placed upon the tram grade with a cherry picker. The lengths of pipe will then be welded together. The pipeline will not be buried.

KING COAL

Minimal earth work and site preparation will occur as the present configuration of the tram line is suitable for installation of the pipeline. Currently growing on the tram line there exists predominately rabbitbrush, sagebrush and weeds. Some vegetation may need to be cleared if it falls in the path of the pipeline. Any surface disturbance created by the pipeline installation will be seeded in the fall with Seed Mix #1 from our reclamation plan.

Reclamation should not be a problem due to the narrowness of the zone of disturbance. Surface disturbance will be very limited and temporary in nature. No changes will be made to the natural drainage of the area. No access to the tram line will be left after the pipe has been installed in order to eliminate unauthorized vehicular travel.

At the end of the 660 foot stretch of new pipeline, a pipe would slope down off the tram and reconnect with the present steel pipe. U.S.. Fuel would like to continue to replace segments of the old pipeline along this road as money becomes available in the future. At present, installation of this 660 feet of pipe should be a substantial improvement by reducing maintenance problems and allowing a critical portion of the road to be maintained more effectively.

Your cooperation in reviewing this request as expeditiously as possible is greatly appreciated. Please call if you have any questions.

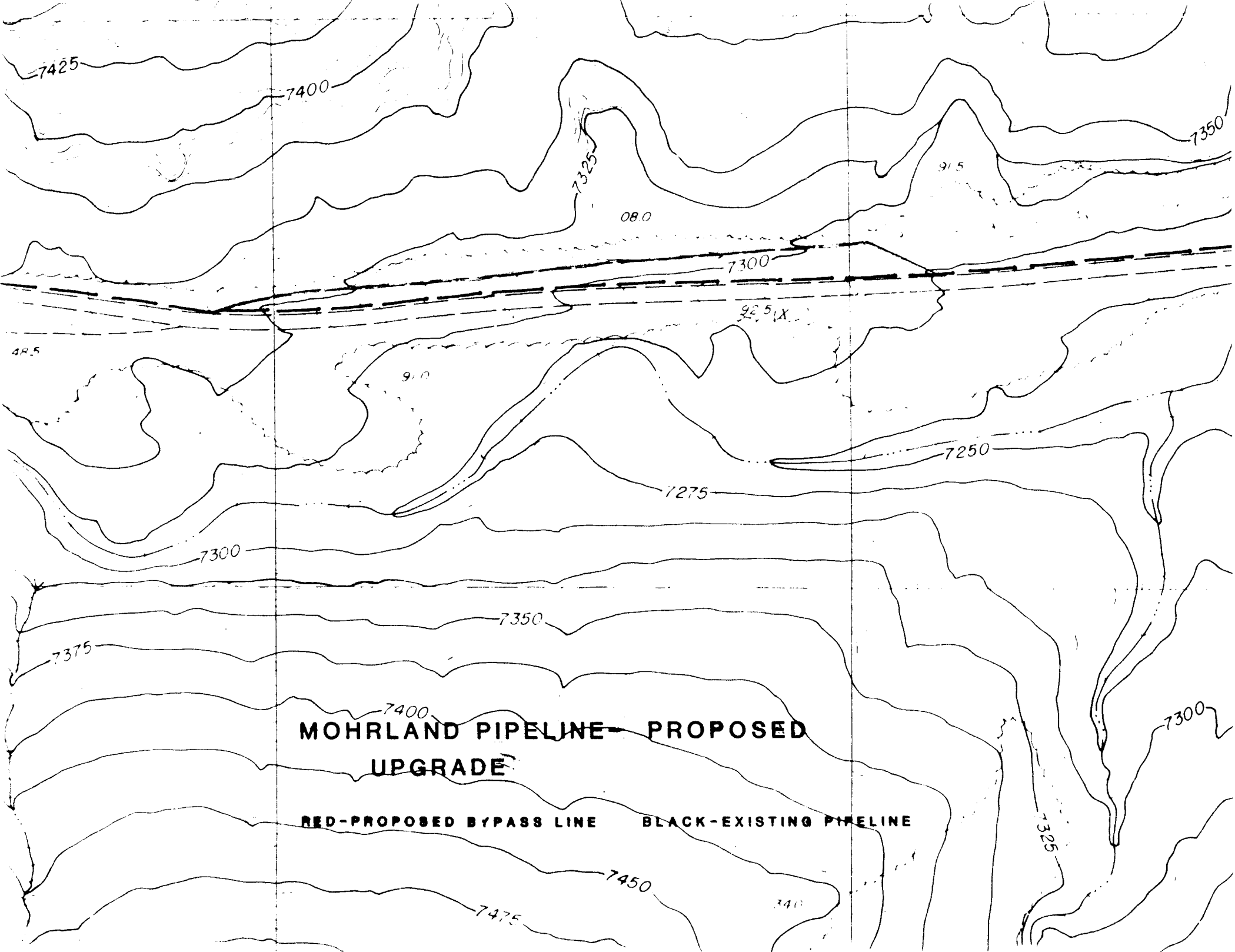
Sincerely,

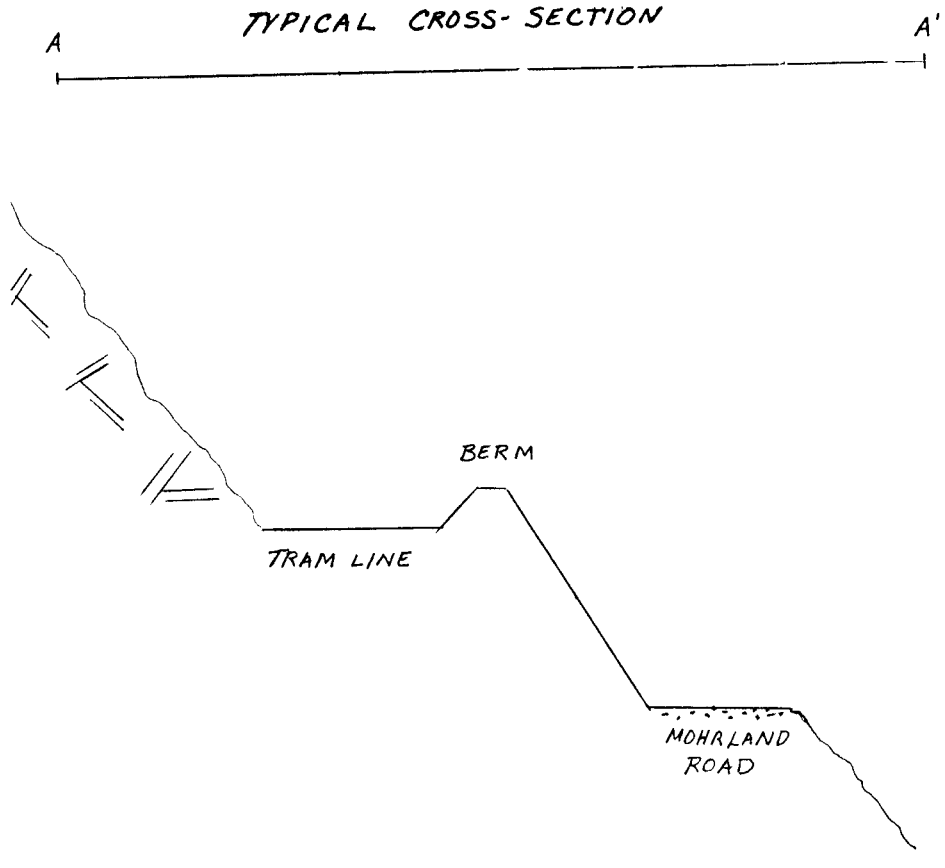
Jean Semborski

Jean Semborski
Environmental Coordinator

pc: E. Gardiner
M. Watson
B. Gunderson

JS:lj


7425
7400
7350
7325
7300
7275
7250
7300
7350
7375
7400
7300
7450
7475
325
MOHRLAND PIPELINE - PROPOSED UPGRADE
RED-PROPOSED BYPASS LINE
BLACK-EXISTING PIPELINE


TYPICAL CROSS-SECTION
A
A'
BERM
TRAM LINE
MOHRLAND
ROAD

APPENDIX III-17

U.S. Fuel Company
Small Area Exemptions

February, 1989

United States Fuel Company
Small Area Exemptions

The following list identifies locations in the permit area that because of their size and location employ alternative methods of sediment control. Figures 1 thru 8, included with this appendix, delineate each area on a contour map and identify site locations by U.S. Fuel coordinates. The area comprising each site is summarized on page 3 of this appendix. The total current disturbed acreage in the permit area is 278.7 acres (Feb. 1989).

HIAWATHA AREA

Topsoil Pile Below Slurry Pond #5

Topsoil stockpiled below slurry pond #5 is located on a pile as indicated on Exhibit III-3 and VIII-4A. The stockpile has been revegetated. It is contained by a berm-ditch sediment control around its' perimeter to control runoff from this site.

Topsoil Pile Below Slurry Pond #4

In 1988 topsoil was stripped from an area below slurry pond #4 and stockpiled adjacent to the site. The pile was seeded, mulched and berm-ditch sediment control was constructed around the perimeter to control disturbed area runoff. See Exhibit III-3 for site location.

Equipment Storage Yard Topsoil Pile

Topsoil was stockpiled at this location in 1978. The pile has been revegetated. Runoff from the topsoil pile would run into the Equipment Storage Yard and would be contained by the sediment control basin which treats drainage from the Equipment Storage Yard area. See Exhibit VII-23 for the site location and depiction of the sediment control structure. This sediment control structure was designed to contain runoff from the topsoil pile along with the runoff from the yard. The sediment control structure is discussed in Chapter III, Page 33 under Equipment Storage Yard Sediment Control and Reclamation.

Area East of Lower Rail Yard and North of Refuse Area

The area directly east of the lower rail yard and north of the refuse area on the map drains to sediment control structures east of the lower rail yard. Runoff from the area east of the lower rail yard and the area north of the refuse storage area contributes runoff to the sediment control

structures. As can be seen from Exhibit III-3 neither the lower rail yard nor the railroad right of way is included as part of U.S. Fuel's disturbed area however, U.S. Fuel has constructed two catchment basins east of the rail yard to contain runoff from this site. The northern catch basin is designed to contain runoff from the area depicted in Exhibit III-3 as well. The southern catchment basin has no diversion ditches but collects drainage directly from a semi-circular zone above it. A cross-section of this basin is shown on Exhibit III-3 also.

Due to the physical constraints of the site it would not be feasible to require a sediment pond to treat drainage from this area. These smaller structures have proven to be capable of handling large flows and spring runoff. They appear to be compatible with the needs of this area and satisfy the intent of the law. See attached calculation sheets.

MIDDLE FORK CANYON

Middle Fork Substation and Water Tank Area

The substation and water tank area is shown on Exhibit F-534 as area "C". It is located at the north end of the Middle Fork disturbed area. The minor amount of runoff from this site is adequately treated by the vegetation surrounding it. A watertight block wall has been constructed around the substation to contain any runoff or spillage within it. As this remote area contains only the substation and water tank, very little activity occurs here.

Middle Fork Timber Yard

Below the Middle Fork mine yard and adjacent to the road is an area used to store timbers for use in the mine. Because of the nature of the material stored here and small area of disturbance, drainage is treated in an alternative manner. Gravel berms help retain water within the disturbed area and channel it toward approved outflow locations. The outflow route passes through a Gabian filter basket filled with gravel to filter any runoff leaving the disturbed area. Refer to Exhibit III-1A and F-534 for site location.

SOUTH FORK CANYON

South Fork Topsoil Pile

The topsoil site in South Fork was established during construction of the South Fork Loadout in 1981. The pile has been revegetated and is protected by a berm-ditch sediment control around the perimeter. Exhibit III-4B and VIII-4 depict the location of this stockpile.

South Fork Water Tank Area

Exhibit III-4A indicates the South Fork water tank and travel corridor with a dashed outline. As the water tank and trail to it have been in place for many years vegetation has become established on and along the trail and around the water tank. The vegetative cover is effective in minimizing erosion and filtering runoff. The trail is utilized to access the water tank only if absolutely necessary. Utilization of the vegetation cover appears to be the best choice of sediment control at this location for several reasons. First, vegetation appears to have worked well in the past, it requires minimal maintenance and it is the most natural and creates the least amount of additional disturbance (no constructed basins or ditches).

NORTH FORK CANYON

North Fork Junction Topsoil Pile

At the junction of the Middle Fork and North Fork roads there is a small topsoil pile. This is the only one at this site although others have been proposed. The topsoil pile is protected by a berm-ditch sediment control and has been revegetated. This site is depicted on Exhibit VIII-4.

North Fork Ventilation Portal Pad

Runoff from the pad area is treated by passing through a filter fabric fence before leaving the disturbed area. Refer to Exhibit III-2 for site location. The area has been revegetated. This location is remote and has negligible activity associated with it.

Acreage Comprising Small Area Exemptions

Site	Acres
Topsoil Pile Below Slurry Pond No. 5	0.28
Topsoil Pile Below Slurry Pond No. 4	0.25
Topsoil Pile at Equipment Storage Yard	0.69
Area East of Lower Rail Yard	4.7
Middle Fork Substation & Water Tank	0.83
Middle Fork Timber Yard	1.28
South Fork Topsoil pile	0.30
South Fork Water Tank	0.42
Topsoil Pile at North Fork Junction	0.06
North Fork Vent Pad	0.63
Total	9.44

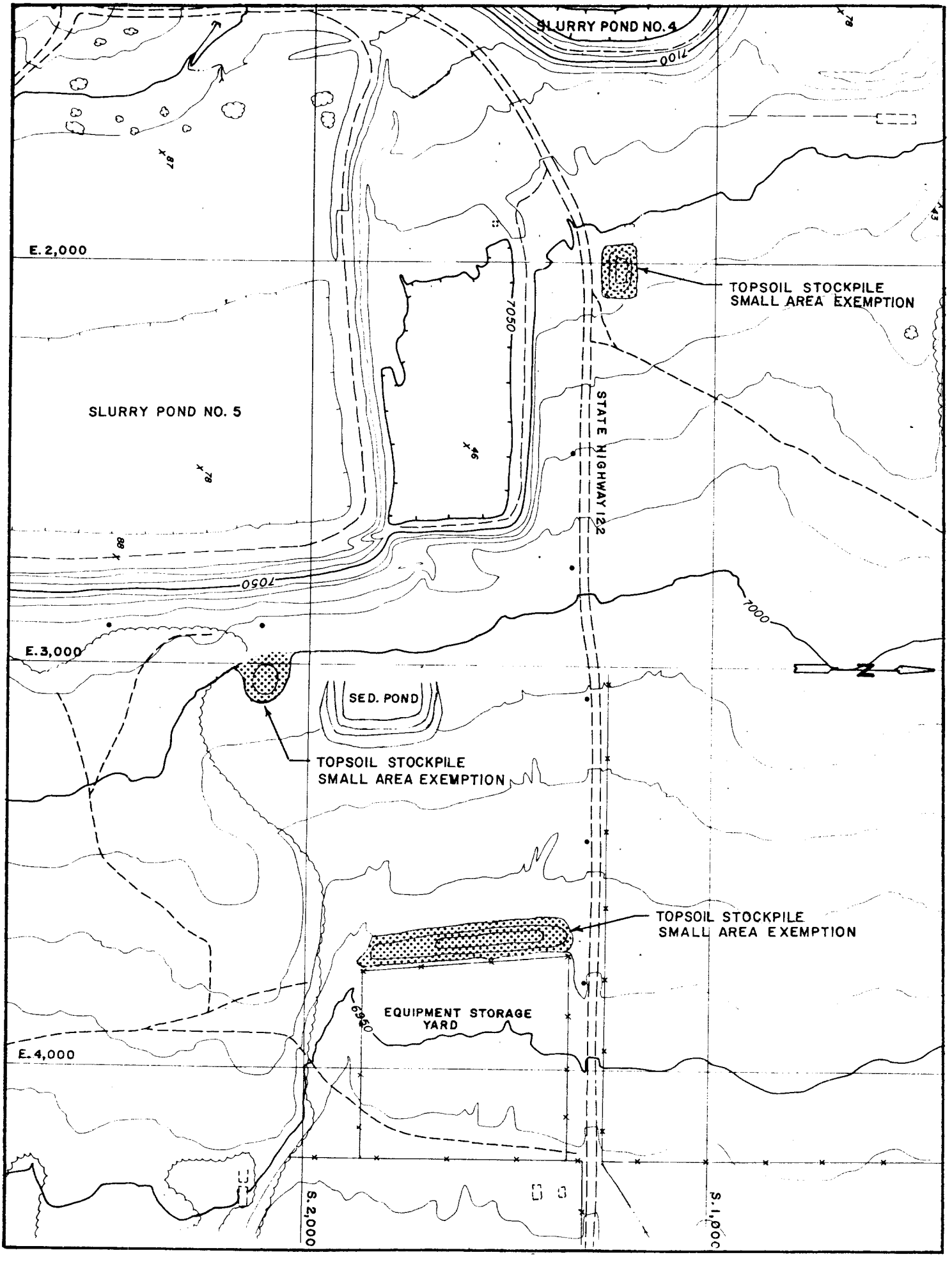


FIG.1 SMALL AREA EXEMPTIONS EAST OF HIAWATHA

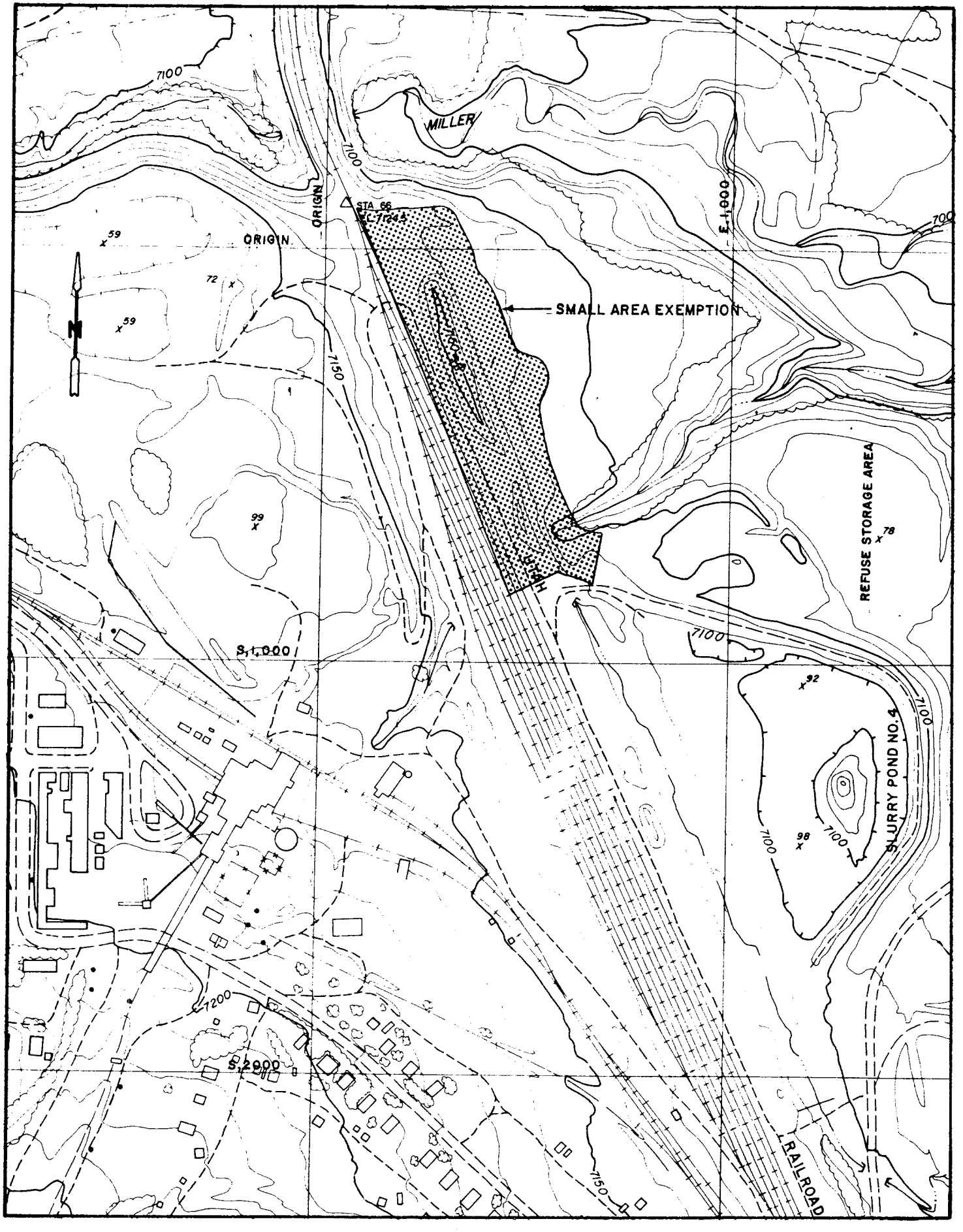
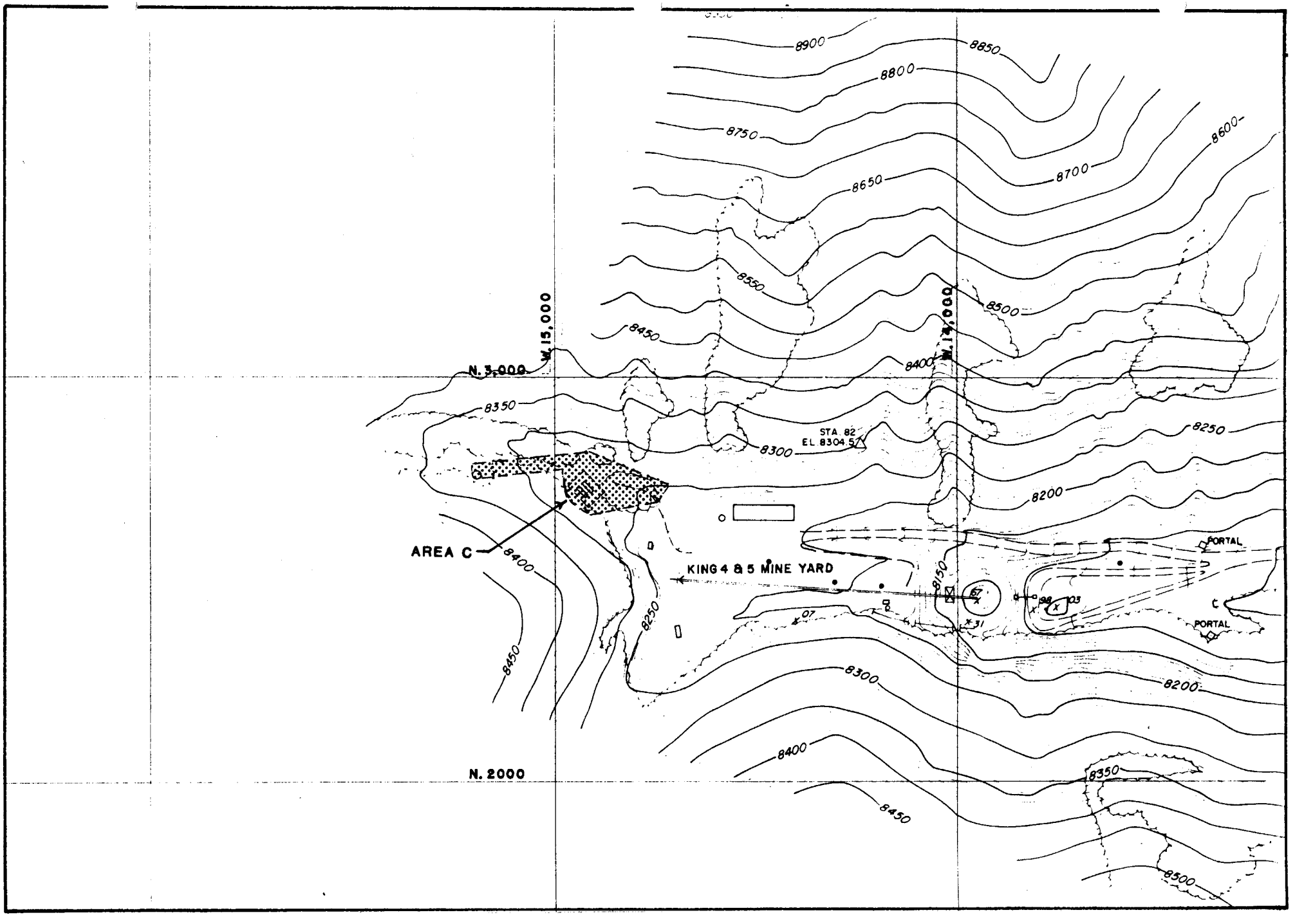


FIG. 2 SMALL AREA EXEMPTION EAST OF LOWER RAIL YARD



FIG, 3 SMALL AREA EXEMPTION MIDDLE FORK SUBSTATION & WATER TANK AREA

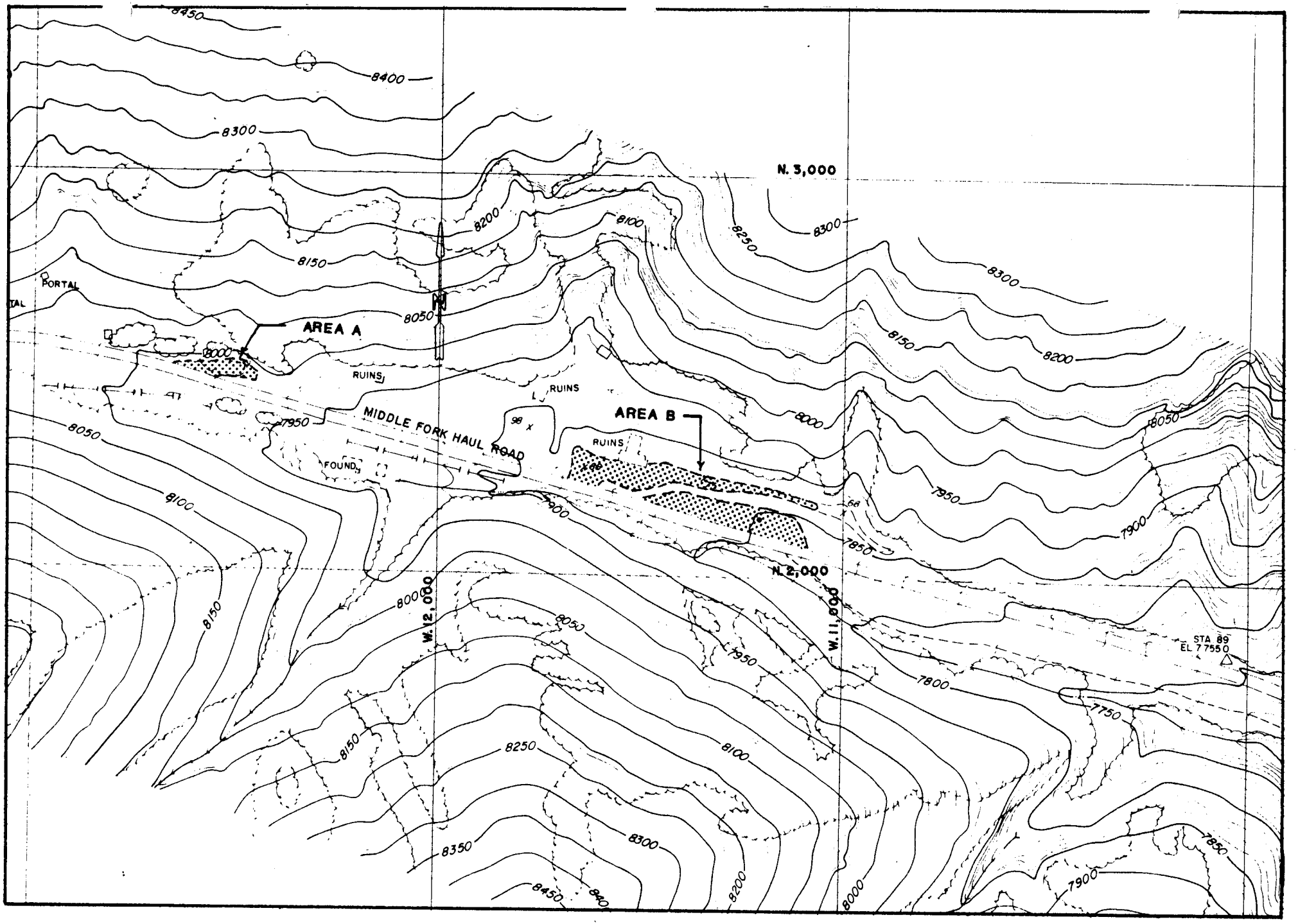


FIG. 4 SMALL AREA EXEMPTION MIDDLE FORK TIMBER YARDS

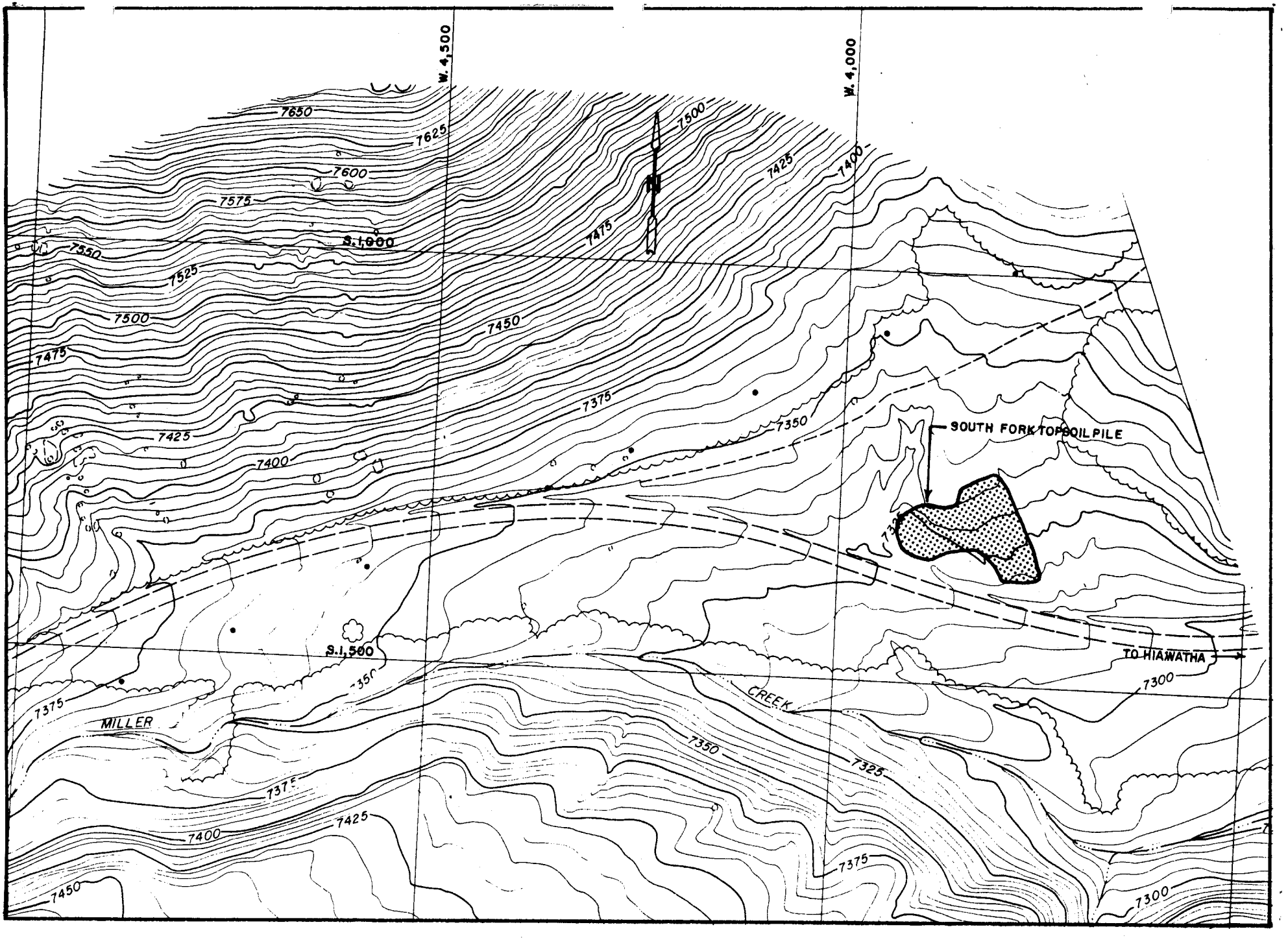


FIG. 5 SMALL AREA EXEMPTION SOUTH FORK TOPSOIL PILE

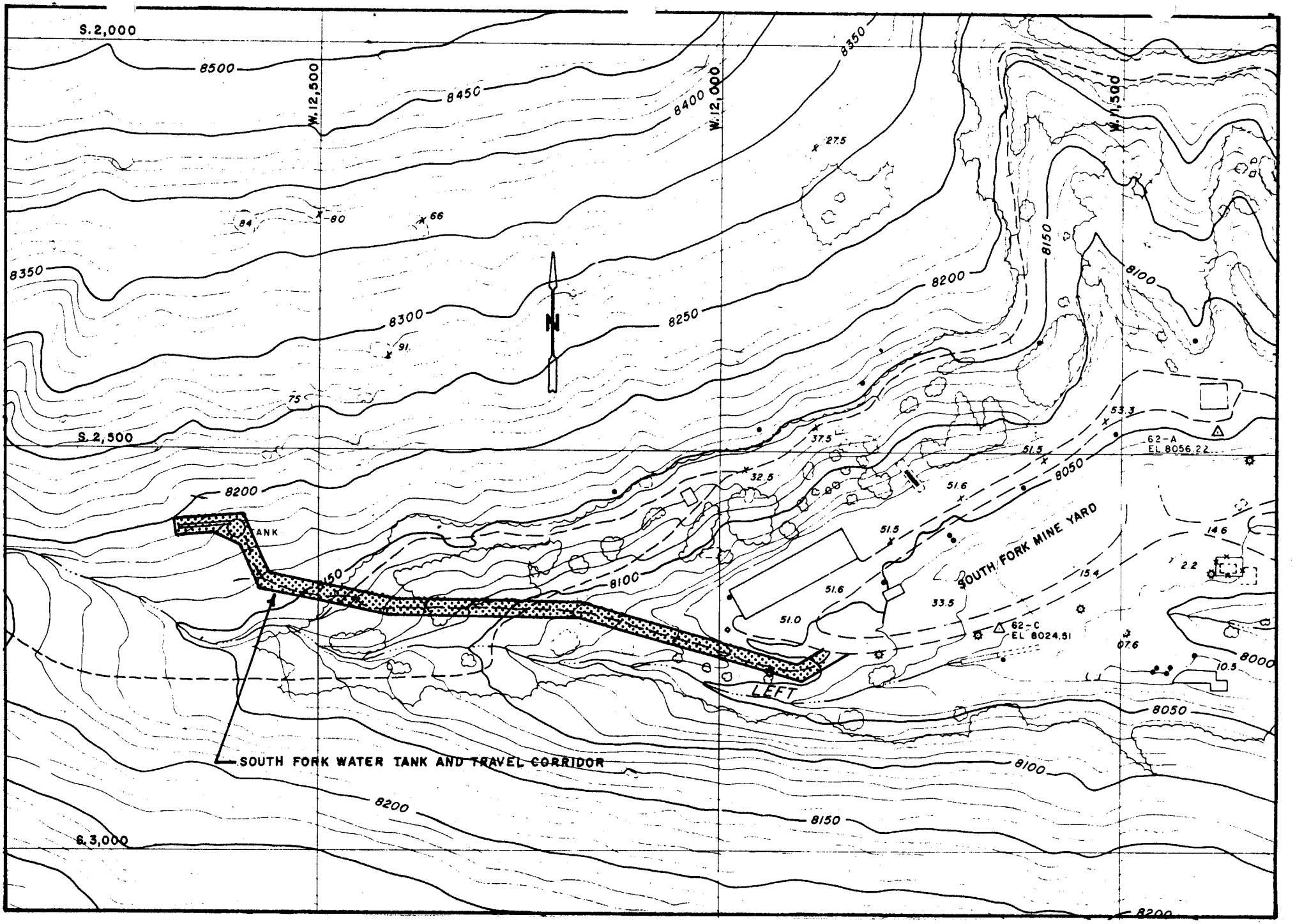
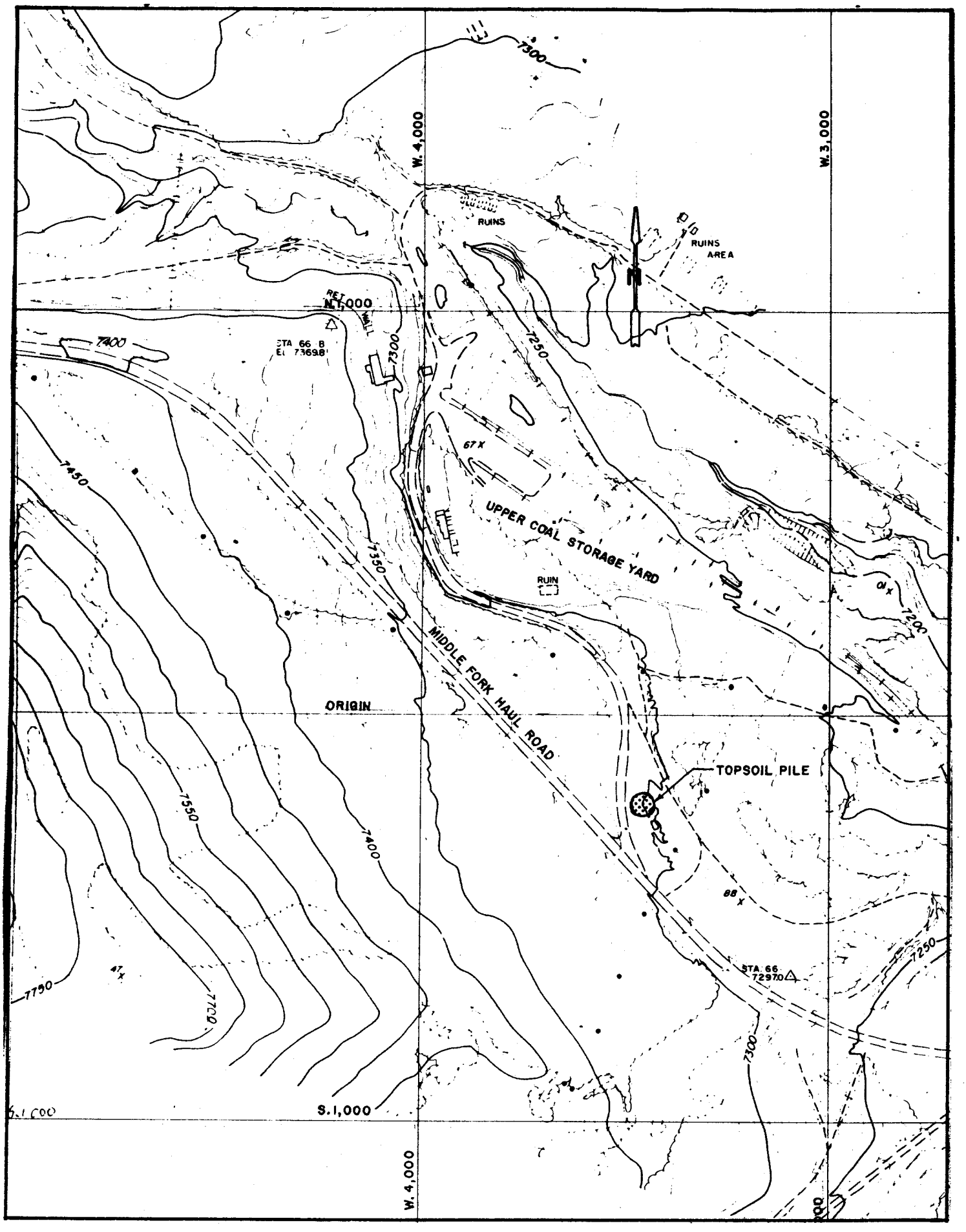


FIG. 6 SMALL AREA EXEMPTION SOUTH FORK WATER TANK AND ACCESS CORRIDOR



FIG, 7 SMALL AREA EXEMPTION NORTH FORK JUNCTION TOPSOIL PILE

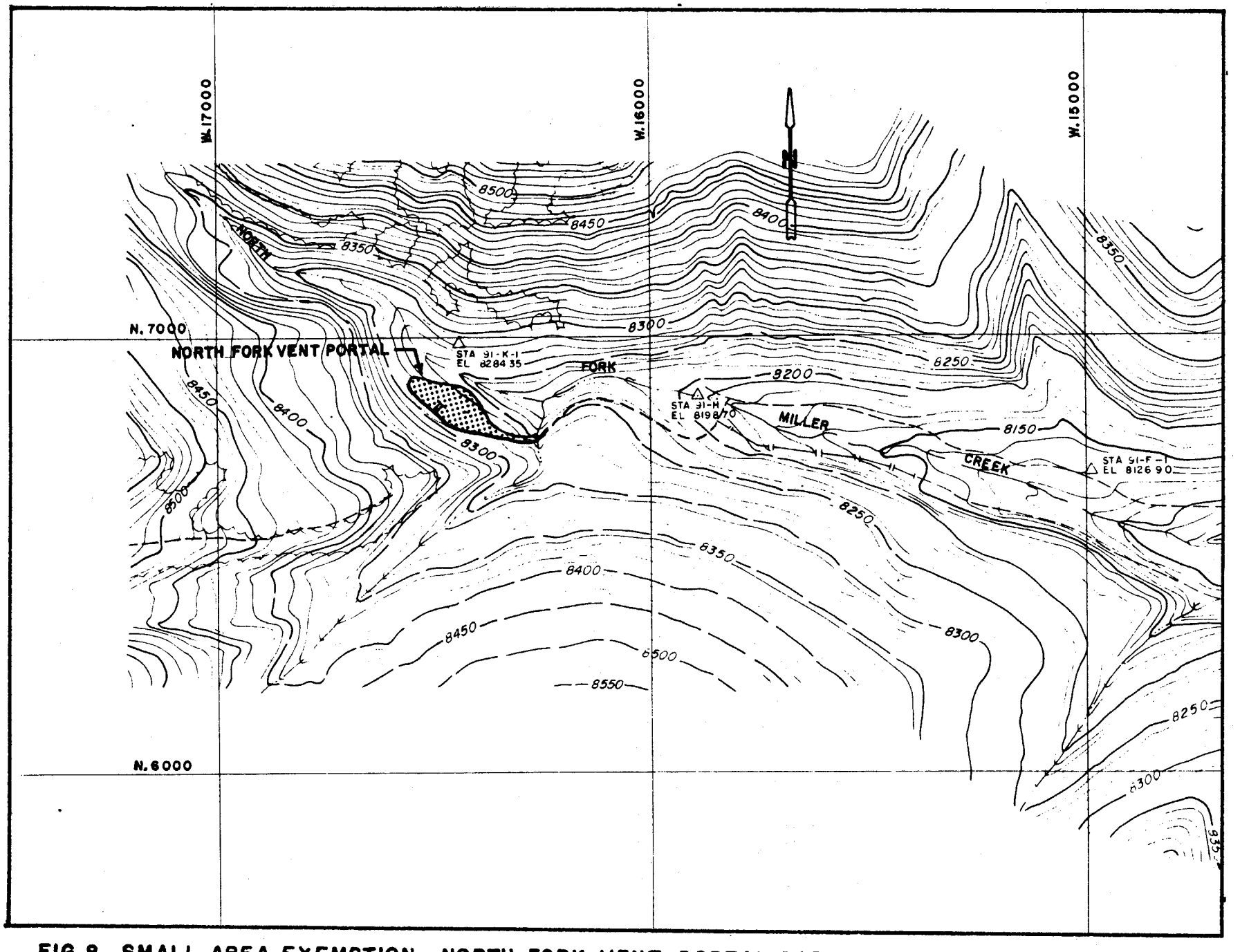


FIG. 8 SMALL AREA EXEMPTION NORTH FORK VENT PORTAL PAD

CALCULATION SHEET

UNITED STATES FUEL COMPANY
ENGINEERING DEPT., HIAWATHA, UTAH
COMPUTATION FOR _____
REF. DRAWING _____

INDEX NO. _____ SHEET NO. _____
PLACE _____
JOB _____
DATE 2-10-89
COMPUTED BY _____
CHECKED BY _____
REVISED _____

PART 2 OF 3 OF TDN 88-2-116-2

DIVERSION DITCH DESIGNS FOR THE MIDDLE FORK LOADOUT YARD, THE UPPER RAILYARD AND THE SOUTH FORK MINE YARD.

PEAK FLOWS FROM DESIGN STORMS (FROM APPENDIX VII-1 OF PERMIT)

SITE	PEAK FLOW
MIDDLE FORK YARD	2.33 CFS
UPPER RAILYARD	2.32 CFS
SOUTH FORK YARD	7.28 CFS

VELOCITY OF FLOW DURING PEAK RUNOFF IS CALCULATED FOR EACH DITCH USING THE MANNING FORMULA.

$$V = \frac{1.486}{n} R^{0.67} S^{0.5}$$

V = VELOCITY OF FLOW (FT/SEC)
n = MANNING'S ROUGHNESS COEFF. = 0.033
A = CROSS SECTIONAL AREA OF FLOW (FT^2)
P = WETTED PERIMETER OF CHANNEL (FT)
R = HYDRAULIC RADIUS = $\frac{A}{P}$ (FT)
S = HYDRAULIC SLOPE (FT/FOOT)

CALCULATION SHEET

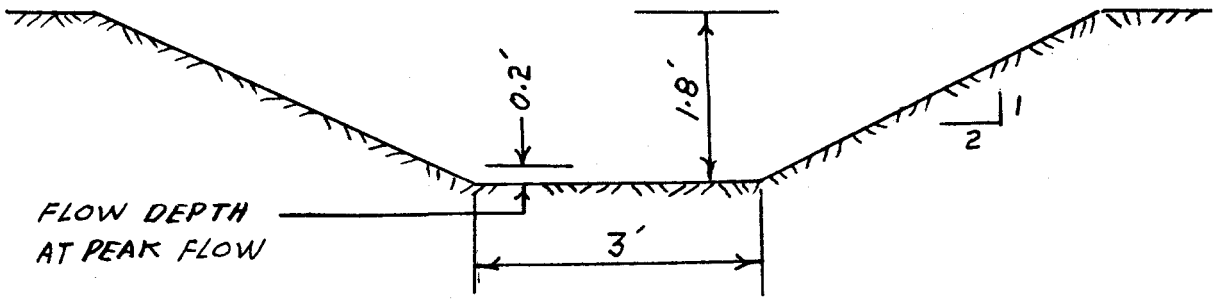
UNITED STATES FUEL COMPANY
ENGINEERING DEPT., HIAWATHA, UTAH

COMPUTATION FOR MIDDLE FORK DIVERSION DITCHES

REF. DRAWING

INDEX NO. _____ SHEET NO. _____
PLACE _____
JOB _____
DATE 2-10-89
COMPUTED BY _____
CHECKED BY _____
REVISED _____

1- DIVERSION DITCH NORTH OF TRUCK LOOP - TYPICAL CROSS-SECTION



2- DIVERSION DITCH IN CENTER OF TRUCK LOOP - SAME AS ABOVE

$n = 0.033$

$A = 0.680 \text{ FT}^2$

$P = 3.894 \text{ FT}$

$R = \frac{A}{P} = \frac{0.680}{3.894} = 0.175 \text{ FT}$

$S = 0.067 \text{ FT/FT}$

$V = \frac{1.486}{0.033} (0.175)^{0.67} (0.067)^{0.5}$

$V = 3.63 \text{ FT/SEC}$

CALCULATION SHEET

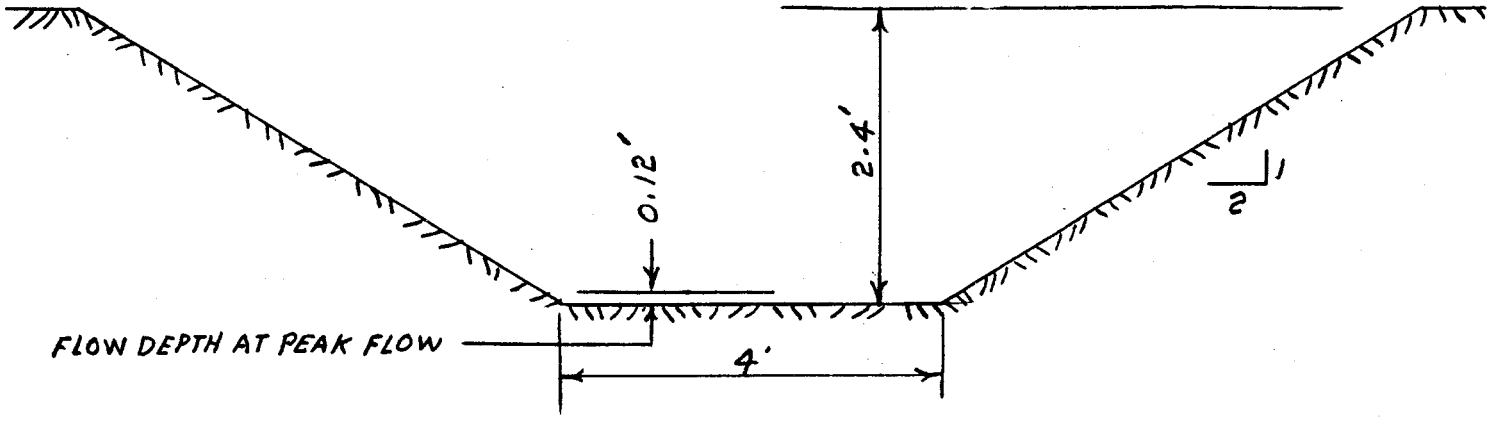
UNITED STATES FUEL COMPANY
ENGINEERING DEPT., HIAWATHA, UTAH

COMPUTATION FOR UPPER RAILYARD DIVERSION DITCH TO SEDIMENT POND

REF. DRAWING

INDEX NO. SHEET NO.
PLACE
JOB
DATE 2-10-89
COMPUTED BY
CHECKED BY
REVISED

1- DIVERSION DITCH FROM RAIL YARD TO SED. POND - TYPICAL CROSS SECTION



$n = 0.033$

$A = 0.509 \ FT^2$

$P = 4.537 \ FT$

$R = \frac{A}{P} = \frac{0.509}{4.537} = 0.112 \ FT.$

$S = 0.20 \ FT/FT$

$V = \frac{1.486}{0.033} (0.112)^{0.67} (0.20)^{0.5}$

$V = 4.65 \ FT/SEC.$

CALCULATION SHEET

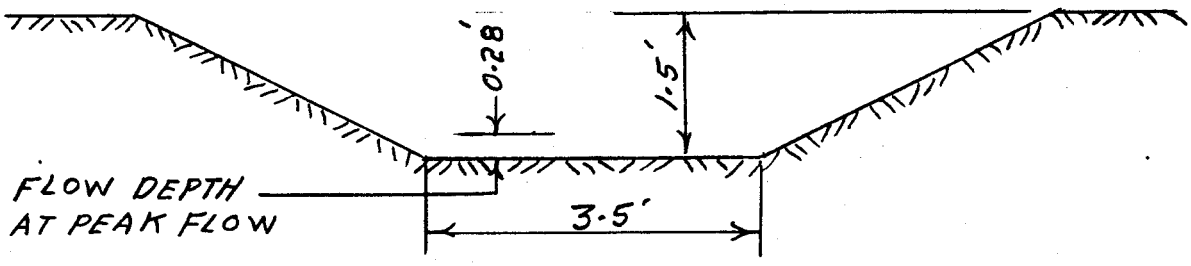
UNITED STATES FUEL COMPANY
ENGINEERING DEPT., HIAWATHA, UTAH

COMPUTATION FOR SOUTH FORK YARD DIVERSION DITCH TO SEDIMENT POND

REF. DRAWING

INDEX NO. _____ SHEET NO. _____
PLACE _____
JOB _____
DATE 2-10-89
COMPUTED BY _____
CHECKED BY _____
REVISED _____

1- DIVERSION DITCH FROM YARD TO SED. POND - TYPICAL CROSS SECTION



$n = 0.033$

$A = 1.137 \ FT^2$

$P = 4.752 \ FT$

$R = \frac{A}{P} = \frac{1.137}{4.752} = 0.239$

$S = 0.15 \ FT/FT.$

$V = \frac{1.486}{0.033} (0.239)^{0.67} (0.15)^{0.5}$

$V = 6.68 \ FT/SEC$

APPENDIX III -18

U.S. Fuel Company

Temporary Crushing, Screening & Loading Facility

February, 1989

This appendix describes a small temporary crushing, screening and loading facility to be constructed within U.S .Fuel Company's preparation plant and coal loadout area.

The facility is located on the north east end of the lower railroad yard as shown in Figure 1. The land is owned by Utah Railway but is included in U.S. Fuel Company's permit boundary.

This site has previously been approved for use as part of a proposed unit train loading facility, however, since this smaller facility is only temporary (approximately 6 months) it will not interfere with that viable proposal.

The facility consist of a loading hopper, a double deck screen, a crusher, two transfer conveyors and three stacking conveyors. All conveyors are approximately 50 feet long. Coal is hauled to the facility by dual trailer, highway approved trucks and dumped in a storage area south of the loading hopper. Coal is loaded into the hopper by front end loader. Coal stockpiled by the stacking conveyors is loaded into railroad cars by front end loader. One conveyor may be positioned to load directly into railroad cars. The facility will process approximately 200 tons/hour and will be operated by U.S. Fuel personnel.

Runoff control structures and other approved regulatory requirements already exist for this site and it has been used for coal stockpiling and loading for many years. See pages III-8 and III-59 for narratives on the Hiawatha processing plant and related structures. Also see Exhibits III-3 and III-14A, III-14A.1 and III-14A.2.

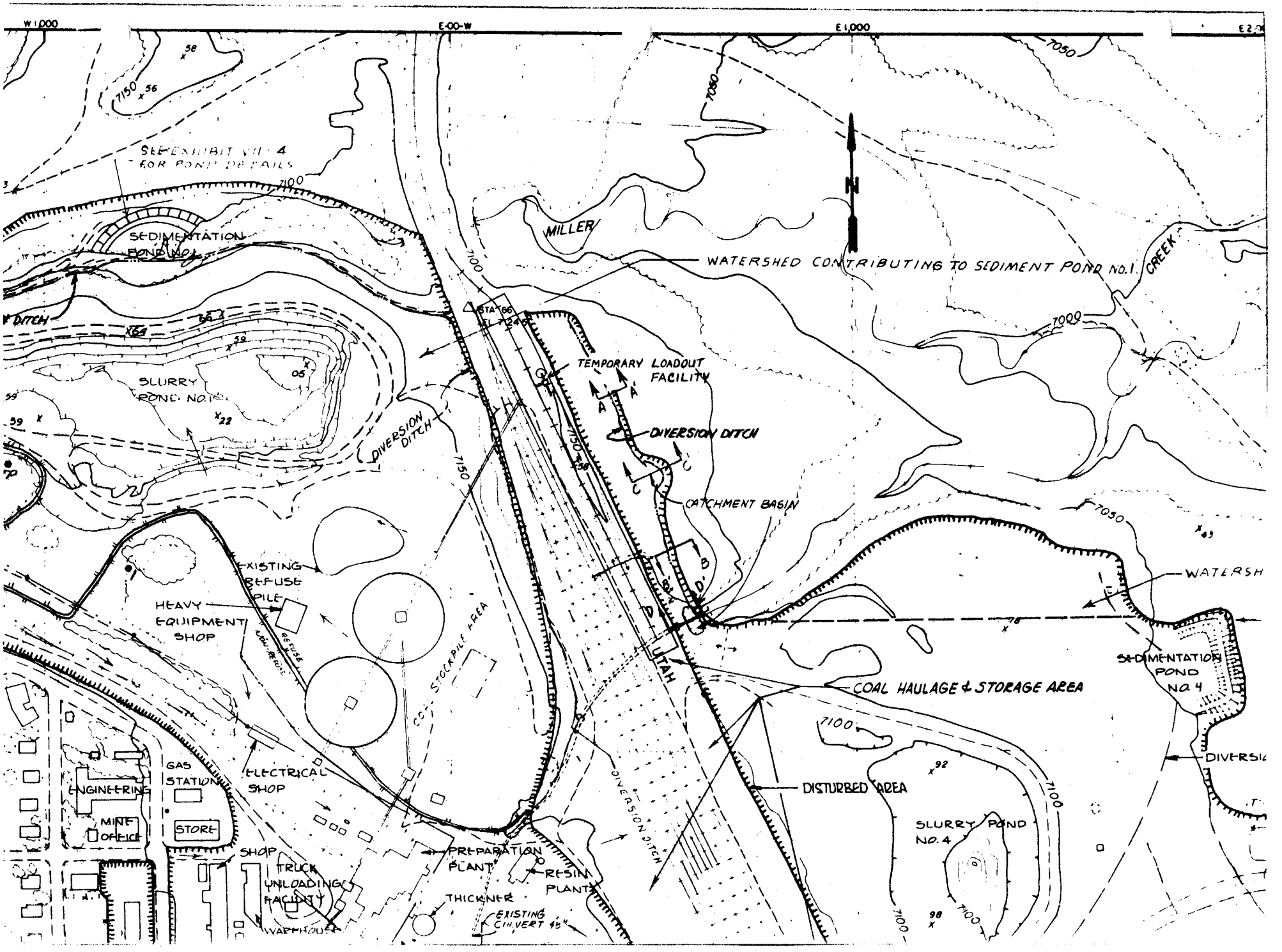


FIG. 1 TEMPORARY CRUSHING, SCREENING & LOADING FACILITY

Chapter IV

LAND STATUS, LAND-USE AND POSTMINING LAND-USE

INSTRUCTIONS FOR CHAPTER IV REVISION

This Chapter IV revision is designed to insert directly in for the existing Chapter IV. The old Chapter IV may then be discarded. Appendix IV-1 United States Fuel Company Property Ownership will remain in it's place with only a change in it's cover page. An Appendix IV-2 Agreement has been added and should be placed behind Appendix IV-1.

An Exhibit Guide Sheet has been supplied so that the reviser can choose only the most current revision and discard all old maps to avoid confusion in the future. The Exhibit Guide Sheet can be discarded after the proper exhibits are assembled. The most current exhibits may be placed behind the Appendices, behind the cover page entitled Exhibits, Chapter IV Land Status, Land Use and Postmining Land Use.

EXHIBIT GUIDE SHEET

IV-1	Surface Ownership Map (dated 9-80)
IV-2	Subsurface Ownership Map (Coal Only) (dated 9-80)
IV-3	Property Map (revised 3-30-83)
IV-3A	Land Use Map Livestock Range Sites (no date)
IV-4	Land Use Map Previous Mine Sites (no date)
IV-1	Surface Ownership Map (stamped Feb. 13, 1984)
IV-2	Subsurface Ownership Map (Coal Only) (stamped Feb. 13, 1984)
IV-3	Mine Permit Area (stamped Nov. 7, 1983)
IV-3A	Land Use Map Livestock Range Sites (stamped Nov. 7, 1983)
IV-4	Land Use Map Previous Mine Sites (stamped Nov. 7, 1983)

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CHAPTER IV LAND STATUS, LAND-USE AND POSTMINING LAND-USE

CHAPTER IV - LIST OF EXHIBITS

CHAPTER IV - LIST OF APPENDICES

4.1 Scope

United States Fuel Company controls in fee and through a variety of leases 20,656 acres of coal land in Carbon and Emery Counties, Utah. The properties are located within the Wasatch Plateau coal field, about three miles southwest of the town of Hiawatha and 15 miles southwest of Price. Exhibits IV-1 and IV-2 show the location of the properties with surface and subsurface ownership.

4.2 Land Status

Surface land status of the mine plan area is a combination of fee lands on the eastern side and the Manti-LaSal National Forest lands on the western portion.

Ownership of the surface is detailed on Exhibit IV-1 with the subsurface ownership detailed on Exhibit IV-2. Specific legal descriptions of property control are provided in Appendix IV-1 and Appendix II-1.

Surface managing authorities consist of two separate and distinct agencies. United States Fuel Company fee lands are bordered on the east, southeast and northeast by the Bureau of Land Management, with the United States Forest Service Manti-LaSal National Forest bordering the fee lands on the west, southwest and northwest. Federal surface control is illustrated on Exhibit IV-1.

Utility corridors traversing the eastern edge of the United States Fuel Company property consist of two Utah Power & Light Company transmission lines. The first transmission line is a 340 KV north-south line connecting Huntington to Provo, Utah. The second transmission line is a 45 KV north-south line connecting into a substation southeast of the town of Hiawatha, that supplies electricity to the mine and town.

Special use permits and leases are limited primarily to grazing leases issued by the Bureau of Land Management and the United States Forest Service Manti-LaSal National Forest region.

The only existing coal leases on the property are federal leases which were obtained many years ago. The leases are as follows:

	SL-069985
	SL-025431
Combined lease	U--026583 and U-058261

Federal coal leases are confined to the western portion of the property and are illustrated on Exhibit IV-2 and Appendix IV-1. 10,000 acres of the coal in the U.S. Fuel Company permit area not under these leases is fee coal.

Mineral ownership in the area is comprised of fee and federal lands. Coal is the only valuable commodity mined in the area. Mineral leases are confined to the western portion of the property and are under federal control.

Oil and gas ownership on the property is comprised of fee and federal lands. In the past, two oil and gas wells were drilled in the proximity of the property but both resulted in dry holes. There is currently no oil and gas production on the United States Fuel Company property.

Federal oil and gas leases on the property are as detailed in Table IV-1.

TABLE IV-1

Federal Oil and Gas Leases In The Mine Permit Area

		Lease Number
Township 15 South, Range 7 East		
Sections 13:	S½	U-17537
24:	N½, SW¼, N½ SE¼, SW¼ SE¼	U-17534
25:	W½, W½ E½	U-17535
36:	SE¼, E½ NE¼	U-21236
36:	W½ NE¼	U-17535
Township 15 South, Range 8 East		
Sections 31:	S½	U-42783
34:	S½ SE¼	U-31707
35:	SE¼ SE¼	U-31707
Township 16 South, Range 7 East		
Sections 1:	SE¼	U-36982
12:	All	U-38968
13:	All	U-23270
Township 16 South, Range 8 East		
Section 3:	E½	U-21129
9:	NE¼ NE¼, NE¼ SE¼	U-22011
9:	SE¼ NE¼	U-42784
10:	N½, N½ S½	U-14454
11:	N½, N½SE¼, NW¼ SW¼	U-14454
15:	SW¼ NW¼, NE¼ SW¼ SE¼ NE¼, E½ SE¼	U-14454
15:	W½ SE¼	U-34988
19:	S½ N½, SE¼, SW¼	U-23794
20:	SE¼ NW¼, NW¼ SW¼, E½ SW¼	U-23794
20:	SW¼ NW¼, SW¼ SW¼	U-42784
21:	SE¼ SW¼, S½ SE¼	U-23852
21:	NE¼ SE¼	U-42784
22:	SE¼	U-17416
22:	SW¼, W½ NE¼, S½ NW¼, NE¼ NW¼	U-14455
23:	SE¼	U-19013
23:	N½ NW¼, SW¼ SW¼	U-17416
23:	NE¼, S½ NW¼, N½ SW¼, SE¼ SW¼	U-14454
27:	SE¼	U-17416
28:	NE¼ NW¼, NW¼ SE¼, SW¼ SW¼	U-26309
28:	NE¼, E½ SE¼, SW¼ SE¼, SE½ SW¼, N½ SW¼, S½ NW¼, NW¼ NW¼	U-20763
29:	SE¼ SE¼	U-45422
29:	SW¼ SE¼, SW¼ SW¼, SE¼ NW¼	U-26309
29:	NW¼ SE¼, SW¼ NE¼, SE¼ SW¼, N½ SW¼, N½ NW¼, SW¼ NW¼	U-20763
30:	All except SE¼ NE¼	U-23794
33:	SE¼ NW¼, SE¼ SW¼	U-26309
33:	E½, N½ NW¼, SW¼ NW¼, NE¼ SW¼, W½ SW¼	U-20763
34:	N½ SE¼	U-34988
34:	W½, NE¼, SE½ SE¼	U-14455

4.3 Land Use 783.22 (a)(1)

Regional land use consists primarily of mining, grazing, recreation, and forestry related activities. No developed recreation sites exist in the area. There is some dispersed recreation associated with camping, hiking, sightseeing and big game hunting in the fall.

Land use in the mine plan area has remained pretty much unchanged since the early part of this century. These uses include livestock grazing, logging, mining, wildlife habitat, watershed, dispersed recreation and oil and gas exploration.

The first significant use of the land was for livestock grazing. In the 1880's, the Miller Brothers ranged large herds of cattle and sheep on the Wasatch Plateau and surrounding lowlands from Scofield to the Colorado River. Their headquarters were at the Millerton Ranch (now owned by U.S. Fuel Company) on Miller Creek approximately four miles east of Hiawatha. The ranch and mountain rangelands are still being used though at a lesser intensity. The Soil Conservation Service, at the request of U.S. Fuel Company, recently compiled a grazing plan for the mine property area.[1] This plan identifies five range types and addresses soils, vegetation and productivity. The following is a description of range sites derived from the plan. Exhibit IV-3 shows the site locations.

Aspen-Grass Ecosystem	This site occurs mainly on high, flat ridgelands at elevations of 8500 to 9500 feet. Rainfall is 22 inches or greater. Soils are medium textured and deep. Infiltration rate and water holding capacity are high. The over-story is quaking aspen. Understory includes brome grass; blue wild rye; bearded, slender and western wheatgrass; Columbia and Letterman's needlegrass; peavine; butterweed; lupine and American vetch. Potential production ranges from 2750 to 4000 pounds per acre. This range occupies approximately 3,000 acres or 16% of the total land area. Potential usage is 500 animal use months.
High Mountain Loam	This range type covers approximately 1,600 acres or 9% of the total land area. It occurs on gently sloping to steep (20 to 60%) mountain slopes and commonly in association with the aspen-grass type. Soils are deep and well drained. Common plants include

mountain brome; bullgrass; bearded, slender and western wheatgrass; Columbia and Letterman's needlegrass; lupine; larkspur; big sagebrush; snowberry and oak brush. Plant communities contain 45% grass, 30% shrubs and 25% forbs. Potential production is from 1300 pounds in unfavorable years to 2700 pounds in favorable years. Potential usage is from 300 to 800 AUMS.

Mountain Stony Loam

Range of this type covers approximately 3,400 acres or 18% of the total land area. It occurs primarily on north and east facing slopes at elevations between 7000 and 9000 feet. Rainfall is 16 to 22 inches. Slopes vary from 30 to 60%. Soils are deep and well drained with over 50% of the profile being very gravelly, stony or cobbly. Infiltration and internal water movement are good. Water holding capacity is moderate due to high content of rock fragments. Plant communities consist of 65 to 75% grass, 15 to 20% shrubs and 5 to 10% forbs. Important plants include bullgrass; muttongrass; bluebunch wheatgrass; Letterman's needlegrass; lupine; big sagebrush; snowberry; mountain mahogany and bitterbrush. Potential production is 1000 pounds per acre in unfavorable years to 2500 pounds in favorable years. Potential usage is around 500 AUMS.

Mountain Shallow Loam

This type of land covers approximately 1,200 acres which is 7% of the total land area. It is found on steep mountain slopes ranging from 30 to 65%. It is primarily found on south and west exposures and ridge tops at elevations of 7500 to 9000 feet. Rainfall is from 16 to 22 inches. Soils are stony or cobbly and shallow (10 to 20 inches) over bedrock. They are well drained, but water intake rate is moderate to slow. Water holding capacity is low due to shallow depth and rock fragment content. Plant communities include 50% grass, 45% shrubs, and 5% forbs. Common plants include bluebunch wheatgrass, Letterman's needlegrass, great basin wild rye, longtongue muttongrass, bullgrass, balsamroot snowberry and bitterbrush. Production is from 600 to 1700 pounds per acre. Potential usage is from 170 to 550 AUMS.

Pinyon-Juniper Grass Areas	Land of this type, which is accessible to livestock, occupys approximately 1,500 acres or 8% of the mine plan area. It occurs on south and east facing hillsides at higher elevations and on benchlands at lower elevations. Rainfall is from 12 to 16 inches per year. Soils are medium textured, have good infiltration rates and generally store all the moisture that normally falls. Pinyon-Juniper accounts for 50% of total production. Other plants include bluebunch and western wheatgrass, Indian ricegrass, bluegrasses, needle and thread grass, bitterbrush, big and black sagebrush, and serviceberry. Production can range from 950 to 2600 tons per acre.
Inaccessible Land	Approximately 8,500 acres or 42% of the mine plan area is considered to be unsuitable for livestock range land. It is more or less inaccessible due to steep slopes, rocky ledges or dense stands of spruce-fir timber.

Some logging had been done in this area in earlier days. Historical accounts note that a sawmill was located near the forks of Miller Creek around the turn of the century. Since that time, and into the early 1930's, logging intensified somewhat due to the need for mine props for roof support in coal mines which began operating around 1909. Very little logging has been done in recent years since better quality and less expensive mine props can be shipped from the Uinta Basin.

In the Manti-LaSal National Forest, of which part of the mine plan is included, the Forest Service estimates standard component sawtimber volumes of 10,000 board feet per acre for conifers and 5,300 board feet for aspen.[2] An extensive timber survey was performed by the Forest Service in 1929 in connection with mine prop logging on U.S. Fuel Company property near Hiawatha. The survey notes that there were no even aged stands of timber except aspen. "The coniferous species are all adapted to growing under considerable shade and consequently have developed all age stands".[3] The following data derived from the survey is included as a guide to existing conditions since little logging or unnatural changes have occurred since that time.

TIMBER SPECIES DISTRIBUTION - HIAWATHA AREA 1929

FOREST TYPES	ACRES	PERCENT OF TOTAL AREA
60% or more Douglas fir with alpine fir, white fir and spruce	1,651	7
60% or more white and alpine fir with Douglas fir and spruce	1,538	6
Varying mixture of alpine and subalpine species	241	1
60% or more Aspen often nearly pure but also with conifers	2,069	11
Pinyon-Juniper, Grassland-Brush scattered or stunted spruce-fir	13,707	75

AGE DISTRIBUTION (CONIFERS ONLY)

AGE		DIAMETER	PERCENT OF TIMBERED AREA
Saplings	0-40 years	Under 4"	0.5
Poles	40-80 years	4" to 8"	9.0
Intermediate	80 to 160 years	8" to 12"	39.0
Mature	120 to 160 years	Over 12"	14.0
Overmature	Over 160 years	Over 12"	15.0

Coal mining in this area began just after the turn of the century. During that time, the Consolidated Fuel Company, the Blackhawk Coal Company and the Castle Valley Coal Company opened mines in the canyons west of Hiawatha and Mohrland. Early mining was almost exclusively in the Hiawatha seam which has been the predominate coal producing seam in the area. The United States Fuel Company acquired the properties of the above mentioned companies in 1915 and since then has mined in the Hiawatha seam, the A seam (0 to 60 feet above the Hiawatha seam) and the B seam (50 to 120 feet above the Hiawatha). Eight significant mines have developed since the beginning of mining in this area. Five of these have been abandoned and two are currently operating. See Exhibit IV-4. Coal extraction has been entirely by the room and pillar mining method. Mining has continued uninterrupted for a period of over 70 years with a total production of over 45 million tons.

The mine plan area contains habitat for numerous wildlife species. The varied topography and diversity of vegetative environments ranging from semi-desert shrubs to high mountain forests provide a variety of life zones for game and nongame animals. The mine plan area and surrounding lands contain both summer and winter range for big game animals and are included in deer management area numbers 33 and 34, and elk management area number 21.

There are no developed recreation sites in the area, though dispersed recreation such as camping, hiking, sightseeing and especially big game hunting have been and are increasingly prevalent.

The upper reaches of Miller Creek and Cedar Creek are municipal water sheds, providing domestic water for the town of Hiawatha, industrial water for mining and coal processing, and agricultural water for irrigating farm lands furthur downstream. Stream flow, depending on seasonal variations, is from 0.1 to 4 cubic feet per second for Miller Creek and 0.8 to 4.5 cubic feet per second for Cedar Creek.

Some oil and gas exploration has been done in the past and most likely will continue due to increased demand. Although there are no oil or gas wells in the mine plan area, several have been drilled on adjacent lands. The potential for oil and gas discovery in this area is high with estimated reserves for the Gentry Mountain area averaging 28 billion cubic feet of gas and 12 billion barrels of oil.[4]

The mine plan and surrounding areas are classified as recreation, forestry, grazing and mining lands under local county zoning ordinances. Due to rugged topography however there are no croplands in the area.